VOLUME 38
NUMBER 10

OCTOBER, 1951

plating

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See Contents Page 1027

Low Micro-Inch Surface Economically Produced

With SPEE-D-BURR PROCESS*

In an Oblique or Horizontal Tumbling Barrel

Operating procedures are outlined on pages 12 and 13 of the Clapp Barrel Finishing Manual and on page 17 of the 1951 Clapp Cleaning Catalogue. A request on your company letterhead will bring this information to you.

Our local Clapp Service Representative will also call to explain fully all details.

*Patent Pending

FREDERICK GUMM

Chemical Company Inc.

538 FOREST STREET, KEARNY, N. J.

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Enthone metal strippers

no attack on the base metal

strip in barrels, baskets or bulk... without electric current

metal stripper A A new alkaline compound that chemically dissolves nickel, copper, zinc, cadmium and silver from steel without etching or attack. The steel is clean and ready for refinishing. Suitable for rack, basket or barrel stripping. Removes excess silver solder from steel rapidly. Patents pending.

metal stripper N-165S A compound added to acid solutions to promote rapid stripping of nickel, tin and lead coatings from copper alloys. No electric current is required.

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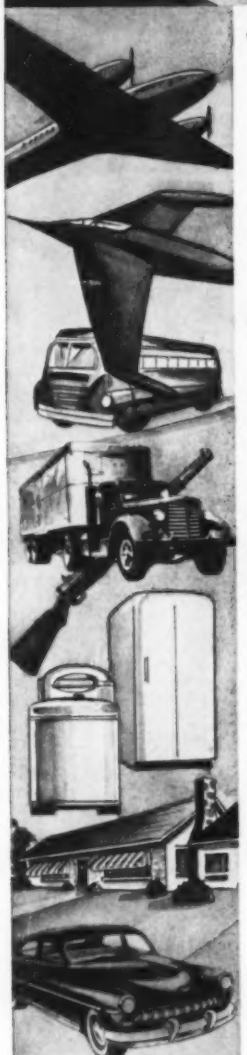

PAINT BONDING

"GRANODINE"® forms a zinc-iron phosphate-coating bond on sheet metal products—automobile bodies and fenders, refrigerator cabinets, etc.—for a durable, lustrous paint finish.

"LITHOFORM"® makes paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE",® the new ACP protective coating chemical for aluminum, anchors the paint finish and protects the metal.

RUST PROOFING

"PERMADINE",® a zinc phosphate coating chemical, forms on steel an oil-adsorptive coating which bonds rust-inhibiting oils such as "Granoleum."

"THERMOIL-GRANODINE"® a manganese-iron phosphate coating chemical, forms on steel a dense crystalline coating which, when oiled or painted, inhibits corrosion.

PROTECTION FOR FRICTION SURFACES

The oiled "THERMOIL-GRANODINE" coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

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"GRANODRAW"® forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

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AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

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Industry News

The American Rack Company, newly founded branch of the National Rack Company, has moved its Chicago office and plant to 4632 W. 21st Place, Cicero, Ill. Mr. Zube, Plant Manager, can be reached by calling Olympia 2-3739.

Sulfur Finds. The announcement by Freeport Sulphur Company that it will develop a major new sulfur mine on the Mississippi Delta means that there is now in sight enough new production of this essential mineral to solve the Free World sulfur shortage of 1,000,000 long tons.

Up to four months ago, private industry, with the encouragement of the Bureau of Mines and the Defense Minerals Administration, had started the development of three new mines with an expected combined production of 530,000 long tons. It a'so had undertaken a number of lesser projects to obtain sulfur from natural and refinery gases and from other sources. Since then additional projects have been announced.

The 500,000 tons planned for the new Freeport mine now increases the expected new production of sulfur to well over the expected deficit. It will take considerable time for all the new output to come in and for the supply to overtake the demand. However, if the projects are carried out as planned and if production from existing sources holds up, the shortage should be over before the end of 1953.

Plating and Organic Finishing Courses. New York University, Division of General Education, 1 Washington Square North, New York 3, N. Y., offers three courses in Surface Technology during its Fall term. They are "Modern Electroplating", "Fundamentals of Paint, Varnish and Lacquer Technology", and a seminar on "New Developments in Organic Finishing". Each course meets once a week for two hours weekly during 15 weeks.

New Movies. Motion Picture Department, Reynolds Metals Company, 2500 S. 3rd St., Louisville 1, Ky., loans to technical societies a 16-mm, full-color motion picture with sound at no cost. Running for 30 minutes, this movie, "The Shape of Things to Come", first takes the viewer on a tour of the Reynolds Metals, Phoenix, Ariz., Aluminum Extrusion Mill. Next, animation is used to illustrate principles and applications of the process. Finally, fabrication operations in many plants using extrusions are shown.

The same company also offers a revision

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means Easier going

Photographs courtesy Allis-Chalmers Mfg. Co.

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For Fast Polishing in All Types of Metal Finishing

For smooth surfaces of moldboard plows and for any tool or equipment where smoothness means more effective work, EXOLON Aluminum Oxide Abrasives assure fast, uniform metal finishing. These chunky, durable grains are magnetically separated, carefully graded and shaped for polishing all types of tough metals, including spring steel, sheet metal, cold rolled stock, forgings and stainless steel. Ceramically coated for strong adhesion to the set-up wheel, EXOLON RST is the ultimate choice for efficient polishing.

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Manufacturers of Silicon Carbide and Aluminum Oxide Abrasives

of the 26-minute, 16-mm, full-color movie with sound, "Pigs and Progress". It begins with the mining of bauxite, its conversion to aluminum, and the electrolytic reduction to metallic aluminum; continues with mill operations for converting aluminum to sheet, plate, foil, wire, rod, powder, and rolled and extruded shapes; and ends with the fabrication of wide variety of products.

The DeVilbiss Company, through its regional sales offices and distributors, has made available a 16-mm color film, "Listen Herman", which runs about 26 minutes. The scene is laid in the office and paint shop of an automobile dealer and deals with reconditioning of automobiles by means of spray painting. It shows that a properly equipped paint shop requires less man power and more efficient use of space.

Chicago Platers Plan Attack

Chicago Platers Plan Attack on Nickel Thieves. Following a meeting on August 21, the Chicago Electro-Platers Institute announced that it would pay a reward of $2,500 for information leading to the arrest and conviction of a gang responsible for a series of Chicago electroplating-shop burglaries in which scarce materials, principally nickel, have been stolen.

The loot in 30 burglaries reported to the Institute since last October is valued at $50,000 at the normal market prices. In the open or "grey" market, the stolen metals would probably bring around $250,000. It included 40,000 pounds of nickel, 3,000 pounds of cadmium, 3,000 pounds of lead, 400 pounds of copper, and 500 pounds of brass.

The Fifteenth Annual Time and Motion Study and Management Clinic sponsored by the Industrial Management Society will be held in the Sheraton Hotel, Chicago, on Thursday and Friday, November 1 and 2, 1951. According to General Chairman Ralph H. Landes of the Western Electric Company, more than 2,000 industrial engineers, works managers, plant superintendents, and supervisors are expected to attend the technical sessions.

Topflight industrial leaders from all over the U. S. will discuss the latest developments in the fields of time study, motion economy, job-evaluation methods, plant layout, materials handling, and human relations. Inquiries may be addressed to the Industrial Management Society, 35 E. Wacker Dr., Chicago 1, Ill.

Federated Metals Establishes Midwestern Department. Federated Metals Division of American Smelting & Refining Company has established a Midwestern Department and appointed Carl J. Gross as its General Manager.

The department comprises the states of

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with

HENDERSON

WOOD TUMBLING BARRELS

- BEST GRADE MAPLE or other woods to specification
- GREATER THICKNESS for longer life
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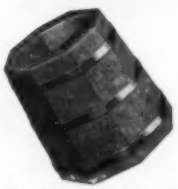
A SIZE AND SHAPE FOR EVERY PURPOSE

8 to 14 sided barrels — 14" to 38" in diameter
Round barrels — all sizes
Horizontal barrels — various shapes and sizes

SPECIAL BARRELS

Where finishing specifications call for a different type barrel, Henderson Bros. is prepared to construct special equipment for practically any purpose.
ALSO barrels in steel, stainless steel, brass, Monel Metal and other alloys.

Large sided wood barrel



Small sided wood barrel

Horizontal wood barrel

Round wood barrel

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SITUATION WANTED

Foreman Plater, chemist. Thirty-five years experience on silver, bright nickel and chrome on nickel silver and carbon steel flatware and cutlery and electropolishing on stainless steel and silver plating Brittania Metal Holloware. Best references.

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Industry News

North and South Dakota, Minnesota, Michigan, Wisconsin, Indiana, and parts of Illinois, Ohio, Iowa, and Kentucky. Federated has two producing plants in this territory, at Whiting, Ind., and Detroit, Mich. Both will be under the direction of Mr. Gross, who will continue as Manager of the Whiting plant. Allan Nichamin, formerly Detroit Sales Manager, has been appointed manager of the Detroit plant to succeed Robert Ruch, resigned. Waldo C. Larson continues as Superintendent at Detroit.

John W. Kelin has been appointed Midwestern Sales Manager with headquarters at Whiting and district sales offices at Detroit under Mr. Nichamin, Cincinnati under Ben J. Lippert, Milwaukee under John L. Kammermeyer, and Minneapolis under Walter H. Schulte.

Men of the cold-forming department of Parker Rust Proof Company, in for a brief seminar at the home office in Detroit, hear James Leland, Manager of the Cold Forming Division, explain a new development in shell-case manufacture using Bonderite as an aid

Parker Rust Proof Company, Detroit, Mich., in 1930 sent Bonderite, its phosphate coating, to Germany (to Metallgesellschaft, Parker's German licensee). Whereas, in the United States the chief use of Bonderite lay in extending paint life on metal, the Germans employed it principally in drawing and cold extruding. By these applications, the Germans were able to manufacture armament from steel (shell, cartridge cases, etc.) which other countries made from brass and critical alloys.

After Parker's men had visited Germany in 1937, they attempted to introduce the new use to American industry. However, the United States was not short of copper, brass, and other materials for which the Germans were substituting low-alloy steels, and the application did not catch on.

Tube mills, however, were gradually taught its advantages, and in 1940–41 started to take advantage thereof. Today 90 per cent of all cold-drawn seamless-steel tubing is said to be treated with Bonderite as an aid in drawing.

After the war, because of the wide publicity given to the German cold-drawing technique, American industry became interested, and the government brought to the United States technicians from Germany to work on some government projects using such technique. For the most part, these technicians came from Parker's

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To take complete charge of new moderate size plating plant of manufacturer of plumbing supplies. Small town, Western Pa. Must have experience on quality standards, capable assume full charge. Salary commensurate with ability. Write fully. Reply to P-1051-B, PLATING, P. O. Box 168, Jenkintown, Pa.

The rapid growth of Bart-Messing Corporation from a modest beginning to the position of being the leaders of the industry as builders of the world's largest Selenium Rectifiers has been an inspiration and a challenge to the industry. The acceptance of Sel-Rex Selenium Rectifiers is proven by the hundreds of nation-wide installations . . . every unit providing indisputable dependability at the lowest cost. (The rectifiers illustrated above are 13,000 amp units at 14 volts, Reactronically Controlled. Recently installed in the plating plant of a prominent automobile manufacturer.)

Sel-Rex Rectifiers can be designed and built to suit your specific needs. Write for literature.

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Sel-Rex Rectifiers are built to give years of trouble-free dependable service. No moving parts to wear out — no shut down time. Sel-Rex Rectifiers incorporate all the latest advancement in design and circuit protection to assure you many years of fine dependable, trouble-free service.

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Your capital investment in a Sel-Rex Selenium Rectifier is considerably lower compared to other DC power equipment. Installation is simpler and requires no bolting to the floor. Alignment is unnecessary. Amp-for-amp Sel-Rex requires less valuable floor space.

MINIMUM OF MAINTENANCE

Sel-Rex Selenium Rectifiers will deliver more ampere hours of plating energy for your maintenance dollar than any other piece of DC power equipment.

Sel-Rex *Complete line of plating and polishing equipment and supplies*

BART-MESSING CORPORATION

229 Main Street, Belleville 9, N. J.

NEMA

Pioneers in Heavy Duty Selenium Rectifier Power

Industry News

German licensee, Metallgesellschaft, and they brought with them, naturally, the phosphate coating material which Parker had sent to Germany in 1930.

The Powers Regulator Company's general office and factory are now located in a new, modern plant at 3400 Oakton St., Skokie, Ill.

Electrochemical Society Fall Meeting. A new electroplating process, reported to offer the first practical approach for plating of aluminum, will be announced at the fall meeting of The Electrochemical Society, October 9–12, 1951, in Hotel Statler, Detroit, Mich. Based on the use of nonaqueous solutions, the new method was developed by D. E. Couch and Abner Brenner of the U. S. Bureau of Standards, and will be described by Dr. Couch during the symposium on electroplating processes at the meeting.

Another feature of this symposium will be the review of a new method for depositing tin-nickel alloys from a chloride-fluoride plating bath, by J. W. Cuthbertson of England.

Dr. F. A. Lowenheim of the Metal and Thermit Corporation will outline American experience with the process of plating tin-zinc alloys. His paper will cover the techniques used to adapt the bath to barrel plating. Data on the corrosion resistance of the alloy will also be given.

Over 500 persons are expected to attend the various sessions, which will also include discussions of Primary Cells, Storage Batteries, Corrosion, Electroorganic Reactions, Electrothermics and Industrial Electrolytic Processes.

Among the highlights of the program will be the three plant visits: on Wednesday afternoon, October 10, a tour of the engineering and research division of the Chrysler Plant, including the modern electroplating equipment now installed; on Thursday morning, a tour of the Ford Waste Disposal Plant recently built at Monroe, Mich.; on Friday an all-day trip to the Dow Chemical Plant at Midland, Mich.

Ackerman

Another highlight will be the Heussner Memorial Luncheon on Thursday, October 11. The speaker will be Paul Ackerman, Chief Engineer of Chrysler.

General Chairman of the Detroit Committee is Wright Wilson of Auto City Plating Company, 197 S. Waterman Ave., Detroit.

Room reservations should be made direct to the Hotel Statler.

Caustic, Chlorine and Perchlorethylene Facilities. A two-year, multimillion-dollar program of plant expansion at the Painesville, Ohio, plant of Diamond Alkali Company has been announced by Raymond F. Evans, president.

The project embraces extensive enlargement and modernization of present facilities which will enable the company to double the plant's output of caustic soda and chlorine. It also includes construction of a new plant for producing perchlorethylene.

By-Pass Precleaning Material Shortages

and Get Faster, Better, More Economical Results!

The Magnus Emulso-Dip Method of Precleaning

Work to be precleaned is dipped into (or sprayed with) the Magnusol cleaning solution . . . made up of Magnusol concentrate and kerosene or safety solvent.

The solution rapidly wets and penetrates the dirt on the work, loosening it so that it is completely flushed off when the work is rinsed with water, steam or safety solvent.

Not only oil and grease, but all solid dirts, including metal particles, are removed. In many cases it is not even necessary to heat the cleaning solution or the flushing water. The solution is nontoxic, non-inflammable and harmless to all metals and to the skin.

There is no shortage of Magnusol . . . or of the petroleum solvents used to make up the precleaning solution employed in the Magnus Emulso-Dip Method.

Even in the days when chlorinated solvents were in ample supply, users of the Magnus Method got better precleaning and far more dependable removal of solid dirts. And they never had to worry about corrosion of equipment, attack on metals or harm to personnel.

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will work on your products. We'll gladly cooperate with you in adapting Magnusol or one of our related emulsifiable solvent soaps to your specific needs. In fact, if you want to work with us in our plant-scale laboratory, you can see the exact results on your own products!

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CLEANERS • EQUIPMENT • METHODS

SITUATION WANTED

Research Director. Metallurgical chemist with broad experience in electroplating, metal finishing and corrosion work; seeks equivalent position. Reply to: P-1051-C, PLATING, P. O. Box 168, Jenkintown, Pa.

METAL SURFACE TREATMENT

Chemist or Chemical Engineer: Productive laboratory worker with sound practical and technical background in phosphating, cleaning, and paint-bonding. Permanent position with advancement. Philadelphia suburban location.

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Barrel Finishing HEADQUARTERS

IF THERE EVER WAS A TIME FOR YOU TO INVESTIGATE THE REMARKABLE LABOR-SAVING OPPORTUNITIES OF

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. . . This is it

There is no lower-cost method of deburring and finishing metal parts. A single unit installation replaces from two to twelve men. We know of no installation that HAS NOT paid for itself in less than a year! In addition to reducing costs (UP TO 95%) almost any type of finish can be obtained from the fast removal of metal to the processing of close tolerance parts to almost any desired micro-inch reading. Investigate the Supersheen Process. Write today for full details.

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS
ALBERT LEA, MINNESOTA

ALMCO SUPERSHEEN LEADS IN BARREL FINISHING ADVANCES

In the last three years startling advances in barrel finishing equipment and techniques have come from the Almco Research Program. Truly ADVANCED equipment has been developed — new super-efficient abrasive media and compounds have been discovered. ONLY ABOUT 30% OF INDUSTRY IS NOW BENEFITING FROM THE TREMENDOUS COST SAVINGS MADE POSSIBLE BY THESE NEW DEVELOPMENTS.

NEW EQUIPMENT

The present line of Almco Supersheen equipment is the most advanced and most complete on the market today! Barrel sizes range from 8" x 16" to 30" x 60". Many different types are now available for finishing parts heretofore finished only by hand. Handling equipment has been improved for speedier loading, unloading and separating.

NEW COMPOUNDS

The new Supersheen compounds are without parallel in the barrel finishing field. These new compounds have played an important part in attaining finer finishes, faster processing. Almco has chosen to develop its own barrel finishing compounds to insure "a better finish faster".

NEW TECHNIQUES

Almco engineers have developed new procedures that broadened the scope of barrel finishing to an almost unbelievable degree. The Almco Supersheen process is now being used by manufacturers in all fields for a multitude of finishing operations — deburring, grinding, cutting down, cleaning, forming uniform micro-exact radii, reducing surface porosity, finishing intricate parts, removing paint, coloring, burnishing, etc. No other techniques, producing comparable results, can operate with such low total paid labor time, moderate requirements of skill, and maintain practically any required production volume.

FREE SAMPLE PROCESSING

Almco maintains America's largest and most complete sample processing and research facilities. Sample processing is done on a "no charge" basis. We invite your samples and inquiry.

FREE

This inside story of Advanced Barrel Finishing. 20 pages of facts and figures. Write for Booklet C-10

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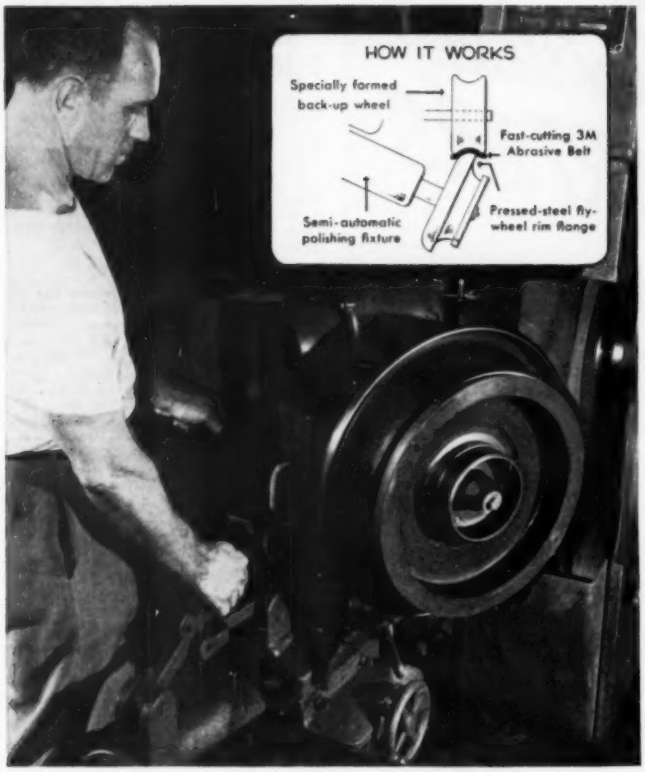

SEMI-AUTOMATIC polishing fixture spins and turns 20" pressed-steel wheel against 3M belt. Back-up wheel is formed to mate with curve of flywheel flange.

"Formed-wheel" belt grinding cuts 3-step job to one!

3M ABRASIVES SLASH GRINDING TIME 71% AT AMERICAN TYPE FOUNDERS

Time study figures prove it! Formed back-up wheels and 3M Abrasives are saving American Type Founders $1.15 on every "Little Giant" press flywheel they finish. A one-step operation now gives these wheels a smoother, cleaner surface in only 7¼ minutes instead of 25 minutes with the former 3-step method, saving 71% on time alone.

Diagram above shows how formed back-up wheel matches the contour of the flywheel rim.

You can make savings in time and money on *your* heavy grinding and finishing by consulting one of our experienced Methods Engineers. No obligation! Write Dept. F-101 for this 3M consultation service.

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minnesota Mining & Mfg. Co. of Canada, Ltd., London, Canada.

Personals

Robert B. Goodsell has been appointed sales and service representative for Enthone, Inc. in the Middle West. His address will be c/o Ardco, Inc., 6665 S. Nashville Ave., Chicago, Ill.

Goodsell

Mr. Goodsell obtained his technical education in schools and colleges in Wisconsin. He has spent 24 years in the electroplating and metal-finishing field and is widely known for his activities in the American Electroplaters' Society. He has been plating foreman, control chemist or finishing superintendent with Greene Manufacturing Company and Racine Plating Company, both of Racine, Wis.; Moe-Bridges Lighting Corporation of Milwaukee, Wis.; A. Y. McDonald Manufacturing Company, Dubuque, Iowa; Nash-Kelvinator Corporation, Kenosha, Wis.; and Camfield Manufacturing Company, Grand Haven, Mich.

R. A. Lees has joined Automotive Rubber Company, Inc., Detroit, Mich., as General Plant Manager of the company's new rubber mill and all processing departments.

Lees

Born in Ohio, he received his degree from Oberlin College, where he was later appointed to a teaching fellowship. His first connection with the rubber industry was as a research chemist in Akron. Work in development, sales and production followed. He served as special consultant to the Rubber Bureau of WPB during the war and more recently to the Rubber Division of NPA. In 1946, Lees built and later managed the West Coast branch factory of American Anode, Inc.

Robert C. Evans has been appointed Executive Assistant to the General Man-

UNICHROME Trade Mark

News about

COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Chromate treating costs reduced

with UNICHROME DIPS for zinc

A system for turning out good BRIGHT finishes

Despite shortages and restrictions, you can still turn out high quality bright finishes by turning to a *combination* finish. This consists of plating as allowed today, and then following up and fortifying the plate with a really tough, *clear* enamel.

United Chromium can help you with the *complete* system – the bright metal finish and the clear enamel. For example:

Unichrome Clear Dip Finish for zinc plate with an application of Unichrome Coating B-115 provides a system with excellent corrosion resistance and appearance similar to chromium.

Or by depositing bright chromium from the Unichrome S.R.H.S.Chromium Bath over thin nickel or no nickel at all, and then using Coating B-115 for extra corrosion resistance, you'll also get a dependable bright finish.

Remember, in United Chromium you have the Company that knows *metal* finishes as well as their requirements in *coatings*. Consult us to learn how Unichrome *combination* finishes can solve your problem.

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United Chromium Limited, Toronto, Ont.

A large automotive supplier is producing a yellow, iridescent, corrosion-inhibiting finish on zinc these days with more ease and less expense. Since switching from a "home made" chromate solution to a Unichrome Dip, the Company reduced material costs alone by nearly a third. And there's less trouble getting as good or better corrosion resistance than specified.

As this case indicates, UNICHROME DIPS provide a means of meeting chromate treating specifications for both civilian and defense production with easy-to-use, long-life, economical solutions.

ANOZINC* is still another process used for chromate-treating of zinc. It's especially suited for mass production, where it offers even greater economies. **Trade Mark*

Dips Do the Job Chemically

The various Unichrome Dips form their conversion coatings *fast*. A simple 5-second to 2-minute immersion does it, producing a surface finish integral with the zinc. You can get *black, olive drab, brass-color, iridescent yellow,* or *clear* finish from solutions which are easy to control.

Anozinc Does It Electrolytically

Anozinc uses conventional plating equipment and gives you a chromate finish with superior corrosion resistance and extra toughness. Parts can be handled wet, eliminating need for drying time and space. Three Anozinc finishes available – *black, yellow* or *clear* – from solutions that have long, trouble-free life.

• • •

Shell cases, propeller blades, bolts, screws, pump and carburetor die castings and many other parts are today getting the benefits of one of these Unichrome Dip or Anozinc finishes. If you want an economical answer to your own finishing problem, investigate them. Write for data.

Plating Hard Chromium in S.R.H.S. Bath continues to save time . . . Time . . . TIME!

Practically "on the double," the Unichrome S.R.H.S. Chromium Solution is speeding along vital defense production work. Look at some of the records rolled up:

Piston ring maker cuts time of chromium plating rings to 3½ hours from 5! Big job shop plates aircraft brake discs in 40 minutes instead of 65! Chromium plating of ring gauges doubled by S.R.H.S. Chromium without extra equipment! A company reports depositing chromium at better than 0.004" per hour rate!

These were all accomplished by using the Unichrome S.R.H.S. Chromium Solution instead of ordinary chromium. And that's not all. S.R.H.S. Chromium also offers you smoother plate, better leveling action, and self regulation. Ask us about it.

✓ For ACIDS
✓ For PLATING SOLUTIONS
✓ For LUSTER-ON® ZINC DIPS
✓ For RINSE TANKS

PLA-TANK®
FIBERGLAS® TANKS

If you plan to replace, or install new chemical-proof tanks, get all the facts about PLA-TANK. Made of Fiberglas, bonded with resins and molded into a one-piece seamless tank, PLA-TANK is impervious to many common acids (hot or cold), plating solutions, bleaches, solvents, bright nickels and zinc dips. That's why

PLA-TANK

aroused so much enthusiastic comment at the recent Electroplaters' Convention at Buffalo. PLA-TANK also has the advantage of low initial cost and fast delivery (one week!). Special sizes and shapes — also low-priced — take only slightly longer. PLA-TANK, especially in custom shapes, represents tremendous savings over materials it replaces. For

PLA-TANK

is a satisfactory substitute for stainless steel, rubber- or plastic-lined tanks, crocks or acid-proof stoneware. PLA-TANK is virtually indestructible. It will not rust, is an excellent dielectric, easily withstands temperatures to 250°F. PLA-TANK has been field-tested in hundreds of installations with exceptionally fine results. Write for free data sheets or engineering consultation. Address inquiries to:

THE Chemical CORPORATION
57 Waltham Ave., Springfield 9, Mass.

Personals

ager of the Western Division of the Atlas Mineral Products Company, with headquarters at Houston, Texas. He is a graduate of Baylor University and was formerly associated with the Sheffield Steel Corporation.

A. Walter Hefti has joined the home-office staff of the J. B. Ford Division of Wyandotte Chemicals Corporation, and **Robert K. Tucker** and **Tom R. Todd** have become Managers of the company's St. Louis and Los Angeles districts, respectively.

Hefti

Mr. Hefti joined Wyandotte Chemicals in 1932 and was located in Akron, Ohio, until 1948, when he was promoted to manage the St. Louis district of the J. B. Ford Division. He was born and educated in Switzerland.

Tucker

Mr. Tucker has been an Industrial Department representative in the Chicago district of Wyandotte Chemicals since 1947. A graduate of Albion College, Michigan, he recently received special training at Wyandotte Chemicals' home office.

Todd

Mr. Todd has recently been on special home-office assignment for Wyandotte Chemicals, preparing for a sales-executive

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THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

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1—6000/3000 AMP, 6/12 VOLT, **BOGUE.** Synchronous Motor. Separately Excited.

1—5000/2500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Separately Excited.

1—5000/2500 AMPERE, 6/12 VOLT, **EAGER ELECTRIC CO.** Separately Excited.

1—3000/1500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Exciter-in-Head.

1—2000/1000 AMPERE, 6/12 VOLT, **A. P. MUNNING** "OPTIMUS."

1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**

1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS CO.** Separately Excited.

1—2000 AMPERE, 50 VOLT, **CHANDEYSSON ELECTRIC CO.** ANODIZER. Synchronous Motor. Exciter-in-Head.

2—1000 AMPERE, 30 VOLT, **IDEAL** ANODIZERS. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON ELECTRIC CO.** ANODIZER. Synchronous Motor. Exciter-in-Head.

2—500 AMPERE, 40 VOLT, **"M. G. C."** ANODIZERS. Separately Excited.

5—**GREEN SELECTROPLATERS,** 1800 AMPERES, 12 VOLTS, for 220/3/60 A.C.

1—**GENERAL ELECTRIC CO.** COPPER OXIDE RECTIFIER, 2000 AMPERES, 6 VOLTS, for 220/3/60 A.C.

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4—**GENERAL ELECTRIC** COPPER OXIDE RECTIFIERS, 500 AMPERES, 6 VOLTS, for 220/3/60 A.C.

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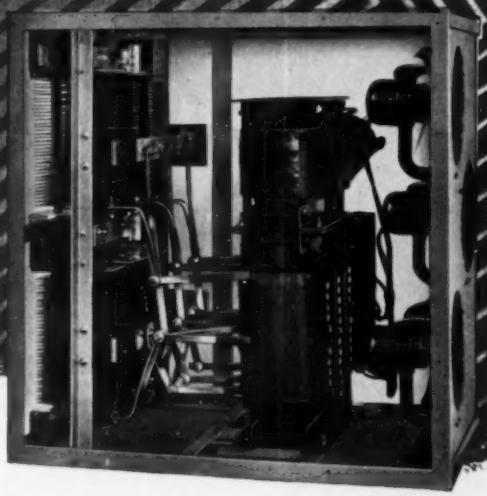

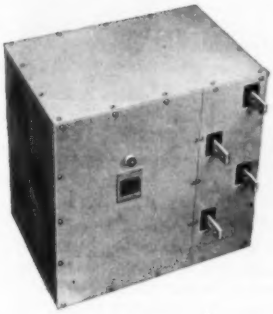

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Of course, you *get* reliability when you install Wagner-Tiedeman Electroplating Rectifiers. Models of conservatism, *proven* DC power source, W-T Rectifiers are deliberately underrated for *safety*, your assurance of full value, continuous efficiency and a long life of trouble-free performance.

But we've given full consideration to the day when replacements may be required at last, due to the day-in, day-out wear-and-tear of grueling service. That's when you discover our parts policy is *unique*. We're continually improving our products; but your W-T Rectifier puts other makes in the "orphan" class—because our engineers see that *these same changes* can be installed in *any* old Wagner-Tiedeman Rectifier. You see, parts are not merely interchangeable; our new developments make your old rectifiers superior in performance to any other make on the market today. Dependable? Yes, for now—and for the years.

On any basis, Wagner-Tiedeman welcomes comparison. Check our fair price; simple installation; low operating cost; infrequent replacement and maintenance; rugged construction and long life expectancy; and, of course, prompt delivery and service. Range available from 2 to 18 volts standard: 6, 9, 12, 18, 24 and 48 volt, in blocks of 1000 or 1500 amperes.

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The Whirlpool Corporation found a real solution to manpower scarcities and rising prices when they installed Roto-Finish Deburring Machines. By this mechanical method, 6 people now deburr an even greater quantity of parts than 16 could do before. Thus a much needed source of manpower was found for use in other operations.

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ORIGINATORS OF THE ROTO-FINISH PROCESSES

Personals

position. He is a native of Kentucky, has lived and was educated in Florida, and has had many years of sales and executive experience in Eastern and Southeastern United States.

Joseph B. Engelhardt is now Sales Manager of The Globe Chemical Co., Inc., Cincinnati, Ohio, manufacturer and distributor of industrial chemicals and chemical specialties. He was formerly associated with the Grasselli Chemicals Dept. of du Pont in Cincinnati and the Midwest. He is a native of Cincinnati.

Samuel S. Johnston, Technical Director, Electrolytic Department, Weirton Steel Company, Weirton, W. Va., and a Past President of the American Electroplaters' Society, was recently featured in

Johnston

Weirton's Employee's Bulletin. Under the heading, "Free Enterprise Keeps Lines of Opportunity Open", it was mentioned that Johnston began as a test boy 29 years ago at $20.00 per week.

Dr. C. K. Banks has been appointed Vice-President in Charge of Research of the Metal & Thermit Corporation, New York City. The company's Director of

Banks

Research since 1949, he is a member of the Research Committee of the National Association of Manufacturers and formerly headed the Chemotherapy Division of Parke-Davis & Company.

Alan W. Brown is now president of the Cro-Plate Company, Inc., Hartford, Conn., succeeding **Theodore L. Brantly, Jr.,** who met his death in an automobile accident on August 8. **Robert C. Allen,** previously Treasurer, has become Executive Vice-President and Treasurer.

Mr. Brown, born in Scarsdale, N. Y.,

is the co-founder of the company, and as Executive Vice-President has been in charge of manufacturing and engineering operations.

Mr. Allen, a native of Hartford, left the Springfield public accounting firm of Miller, Morgan, Inc., shortly after the founding of Cro-Plate to become Treasurer of the new company.

Albert F. Sommer has been added to the sales staff of Minneapolis-Honeywell Regulator Co., Brown Instruments Division, in New York City; **John E. Tutty** in East Orange, N. J.; **James V. Collins** and **Robert F. Trump** in Boston; **Walter J. Loughran** in Providence; **George S. Raab** in Hartford; **John M. Caylor** and **George A. Stiftinger** in Philadelphia; **David Y. Drummond** in Wilmington; **Roy W. Freeman** in Atlanta; **Charles O. McAtee** in Jacksonville; **James T. Emerson** in Greenville, and **Robert D. Clarke** in Mobile.

Also, **Donald P. Moreland** in Cleveland; **Joseph A. Hamblin** in Columbus, Ohio; **John E. Flaherty** in Dayton; **Jack W. Larsen, Wilton A. Bass** and **Vendel W. Immel** in Detroit; **Thomas H. Jenkins, William H. Johnson** and **John L. Matter** in Chicago; **Paul K. Webster** in Indianapolis, and **Philip A. Barker** in St. Louis.

Malcolm L. Johnson in Twin City; **Warren G. Hardy, Carl T. Stevens** and **Herman R. Hampton** in Houston; **Bernard J. Alberts** and **Julius H. Matherne** in New Orleans; **George W. Leggett** in Tulsa, and **Frank G. Fischer** and **Michael J. Joncich** in Los Angeles.

The entire group recently completed a comprehensive course in industrial instrument maintenance and repair at the Brown division school in Philadelphia.

Donald F. Martin has been appointed Regional Sales Manager of the Dagmar Chemical Company. He will cover the New England states, New York and Pennsylvania of this 20-year-old Glenbrook, Conn., manufacturer of lacquers, industrial finishes and related products. Mr. Martin, who will make his headquarters in Springfield, Mass., resigned an executive sales post with the C. W. Haynes Laboratories, Inc., after a 12-year association. Two brothers of Mr. Martin, **Lloyd** and **Raymond,** have joined Dagmar's technical-service staff.

Donald A. Peck, graduate of Bates College; **Peter Franco,** of Harvard University; **Arthur Graff** from the N. Y. Produce Exchange Laboratories, a graduate of Polytechnic Institute of Brooklyn; **David M. Wetstone** of University of Connecticut; **Gonzalo Segura** of Emery and Columbia Universities; **Joseph Pescatore,** formerly with Nuclear Instrument and Chemical Corporation, a graduate of St. John's University, have joined

Here's how two plants solved **ACID SHORTAGE** problems . . .

Case History No. 1

A steel pickling plant handling hot rolled coils reduced sulfuric acid consumption 50% without interrupting normal production. And they got a brighter, cleaner pickling job!

How? By supplementing their sulfuric acid with Wyandotte A.E., the new, easy-to-handle dry acid cleaner.

• • •

Case History No. 2

A manufacturer of steel wire products, using oblique tumble barrels, after heat treatment to remove scale, solved his acid shortage problem by substituting the new Wyandotte A.E. Work came out brighter! And working conditions were better too — with no obnoxious fumes!

Ask your Wyandotte Representative to tell you more about Wyandotte A.E. Or, if you're having a cleaning problem, of *any* sort, write us. Free technical help is available.

Wyandotte A.E.

THE NEW DRY ACID CLEANER

- *Wets out and rinses fast*
- *Gives brighter finishes*
- *Is easy to handle—not dusty*
- *Eliminates water and acid spotting*
- *Does not give off obnoxious fumes*
- *Has long solution life*
- *Is less critical to control*

"Cleaning the World"

THE WYANDOTTE LINE—products for burnishing and burring, vat, electro, steam gun, washing machine and emulsion cleaning, paint stripping, acid pickling, related surface treatments and spray-booth compounds. An all-purpose floor absorbent: Zorbell. In fact, specialized products for every cleaning need.

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Many of our customers have been coming to Storts for years, whenever they had requirements for specially designed and fabricated anodes. One reason was their confidence based on experience, that Stortsfabricated anodes would give them best current distribution. Another reason was the structural perfection resulting from Storts high quality weldmanship.

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the staff of Foster D. Snell, Inc., New York City.

Irving Reich, Research Group Director with Snell, has taken an indefinite leave of absence to study at the University of Southern California for his Ph.D. degree. He will hold a research fellowship and will carry out investigations in the physicochemical theory of detergency. During that period he will continue to serve as consultant to clients of his former employer.

W. C. Richards, Jr., has been named Executive Assistant to the President of The Bellows Company, Akron, Ohio. Mr.

Richards

Richards joined the company in 1947. He had previously been associated with Chamberlain Engineering Corporation, Akron, Ohio.

Charles B. Sanborn, formerly of the American Steel and Wire Company Research Laboratories, Cleveland, Ohio, has joined the staff of Graham, Crowley & Associates, Inc., consulting and research chemists. He will be located in the Chicago laboratories of the company.

Sam Ludsin has been appointed sales representative in the New York and New Jersey area, according to announcement by Schaffner Manufacturing Co., Pittsburgh, Pa.

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Reputable manufacturer and distributor of Plating and Polishing equipment and supplies, established 30 years, representing the most prominent manufacturers, requires a gentleman to act as Sales Manager. This party must be presently employed by a reputable concern in our line as salesman or sales manager and be desirous of making a new connection. The man we want is to act as Sales Manager and naturally must have the necessary qualifications.

An excellent opportunity offered by a Midwestern Company.

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All information will be held strictly confidential.

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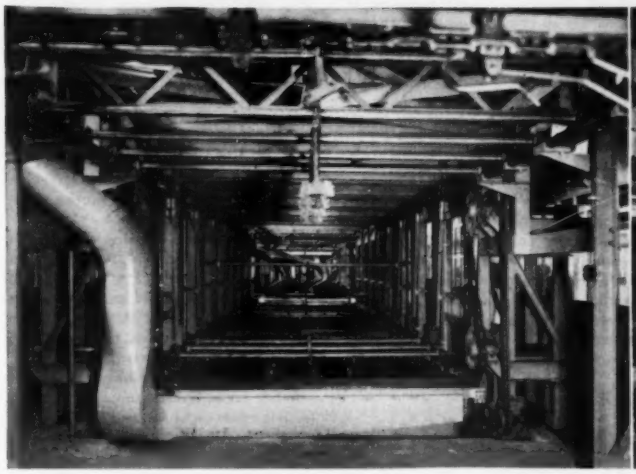
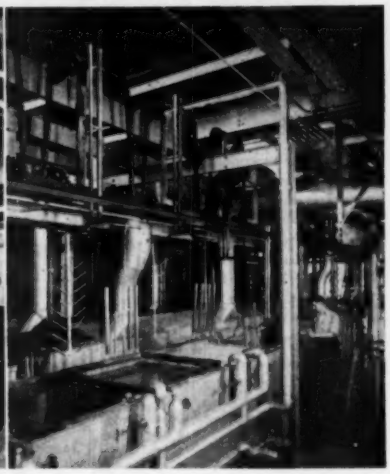
in your plating How to Get Greater Production Improved Quality Better Working Conditions

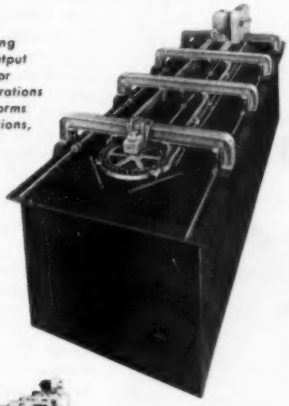


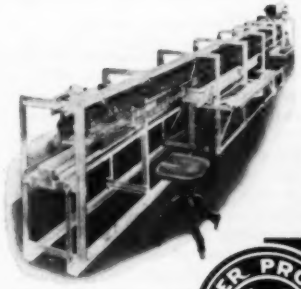
Typical Meaker Straight-A-Way Automatic Plating Machine. This type unit is designed to handle 125 racks or more per hour.



Meaker Return-Type Automatic Plating Machine for chromium-plating the large variety of parts in a high-quality line of plumbing hardware. Machine may be designed to copper plate, nickel plate and chromium plate in one continuous line.

A Meaker Semi-Automatic Plating Machine for use in medium-output plating departments and also for supplementing the plating operations in a Full Automatic which performs the cleaning, preplating operations, final rinsing and drying.





A special machine designed by Meaker for cleaning and silver plating small, brass contact clips.

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Here's how! A Meaker plating machine makes every operation in the plating sequence automatic, or as mechanized as possible. This cuts to a minimum the manual handling of the parts in process—increasing production. The control of the quality of the plating is set and practically independent of the varying human element. A Meaker plating machine does clean up the plating room making for safer and more agreeable working conditions. And a bonus—in many cases the savings in the over-all plating costs have paid for the equipment in a short time.

Look to the handling methods in your plating department. You might be surprised what modern methods will accomplish. Whatever your requirements—full automatic, semi-automatic, or a special machine—Meaker has the answer.

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Trade Litterature

L—668. Phosphoric Acid Cleaner—American Chemical Paint Company, Ambler, Pa., offers a "Deoxidine" Selection Chert which lists its various phosphoric acid metal cleaners and rust removers according to strength, temperature limits, rust and oil removal, etc. This chart also gives concise information about the sequence of operation and the equipment required in each process. For your copy, use Reader Service Card.

L—669. Rubber-lined Tanks, Exhaust Systems, Pipe, Barrels, Utensils—Automotive Rubber Company, Inc., 8601 Epworth Blvd., Detroit 4, Mich., has prepared a new catalog describing its plant facilities, including a new rubber-compounding mill and various products and services.

Automotive Rubber has been identified for years with the automotive, aircraft, electrical, chemical and metal industries as a source for sheet-rubber-lined tanks and form-dipped rubber parts, sold under the "Arco" trade name. The company's expansion now enables it to offer molded and extruded products as well. These are covered in the new catalog. For your copy, use Reader Service Card.

L—670. How to Clean Metals in Aircraft Production—Oakite Products, Inc., 140 Thames St., New York 6, N. Y., has announced the publication of a 48-page illustrated booklet describing specialized materials, procedures and equipment used by leading aircraft manufacturers in cleaning metals, preparing metals for finishing, and for other related processes involved in aircraft production. Included are preparing aluminum for anodizing, spot welding and painting by still-tank method and in spray-washing machines; cleaning aluminum before and after heat treating; stripping paint from aluminum; cleaning magnesium for finishing; treating wash water in paint-spray booths; cleaning aircraft metals for inspection and assembly; and many other operations.

Also presented are helpful recommendations on equipment designed to simplify cleaning and rinsing operations, save manhours and materials, and help assure desired end results with maximum economy. For your copy, use Reader Service Card.

L—671. Organic Coatings to Match Metal Finishes—Maas & Waldstein Company, 438 Riverside Ave., Newark 4, N. J., offers a reprint of an article by its sales manager, B. F. Ames, "Durable Organic Coatings Pinch Hit for Scarce Metals". It deals with Platelustre enamels on highly polished metals to simulate brass, bronze, and copper; Britelume enamels on unpolished steel or other metals to simulate brushed chromium; and clear baking synthetics and clear air-drying lacquers. For your copy, use Reader Service Card.

L—672. Zinc Plating—The Hanson-Van Winkle-Munning Co., Matawan, N. J., has issued a revision of its bulletin "Technical Instruction of S-B Process for Zinc Plating", bringing this process up-to-date. The process produces zinc deposits satin-bright to bright in color that are said to be particularly receptive to conversion coatings such as Lusteron, Cronak, Iridite and Anozinc. For your copy, use Reader Service Card.

L—673. Polishing, Grinding—Behr-Manning, Troy, N. Y., offers a folder, "Blueprints for Faster, Better Production", describing various forms of Metalite Cloth for various polishing uses. It carries six smaller folders, each dealing with a special problem and setting forth its solution. For your copy, use Reader Service Card.

L—674. Barrel Finishing—Norton Company, Worcester 6, Mass., offers a 56-page booklet, "Barrel Finishing with Alundum Tumbling Abrasives". Section I covers features the abrasive, grit sizes, barrel - finishing factors, equipment, cleaners and rust preventives. Section II deals with procedures for roughing and finishing, separation of work from abrasive, washing and drying, rescreening of abrasive, mixing of different parts, and gives detailed examples of procedures. Section III contains practical hints for selecting the abrasive size, screening the abrasive, degreasing, loading the barrel, racking, plugging and masking, barrel speeds, water level, water purity, cleaners, spot checking, rinsing, unloading, wash-

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Spectrophotometric measurements—based on analysis of liquid, solid or gaseous samples by light absorption—have become one of the most important methods of today's process control operations. Complicated analyses requiring hours to perform by standard chemical procedures are now completed in a matter of minutes using modern spectrophotometric methods.

Up to the present, *quality* instruments have been beyond the reach of many laboratories. Now, however, the development of the new Beckman Model "B" Spectrophotometer makes available for the first time a *precision* instrument—convenient and simple to operate—*yet versatile, accurate and low-priced.*

The Model "B" combines many of the advancements pioneered in the famous Beckman Quartz and Infrared Spectrophotometers . . . high resolution . . . wavelength and photometric accuracy . . . freedom from stray light . . . wide spectral range . . . quality construction.

It features direct reading absorbance and transmittance scales . . . complete elimination of stray light from 360 to 1000 millimicrons—less than 1⅛% even at 320 millimicrons . . . interchangeable phototubes for wider wavelength range . . . inexpensive sample cells . . . 4-position cell carriage for faster readings . . . and many other important features.

The Model "B" is by all standards the outstanding instrument in its field. Write for full details.

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How The Model "B" Saves Money in Today's Plating Operations

Spectrophotometric methods of analyzing and controlling the purity of plating baths are becoming increasingly important in today's electroplating processes.

Particularly profitable is the use of the Model "B" for quick, accurate determinations of impurities in various types of plating baths. In bright nickel plating, for example, impurities such as chromium, copper, iron, zinc, aluminum, calcium and ammonium salts substantially restrict the action of organic brighteners, affect the hardness and brittleness of the coating, decrease salt spray resistance and cause other difficulties.

The Beckman Model "B" provides a means for modern platers to determine such impurities accurately and conveniently without the need for skilled technical personnel or complicated chemical procedures and equipment. It is low priced and simple to operate—yet it is a **precision** instrument, with wider wavelength range, better accuracy and greater versatility than any other low priced spectrophotometer or colorimeter.

Just one defective plating run can cost considerably more than the low price of the Model "B"—so investigate now the many savings this Beckman instrument can make for you in faster plating, fewer rejects and better quality.

✻ Beckman Instruments include: pH Meters and Electrodes • Spectrophotometers—Radioactivity Meters—Special Instruments

Trade Literature

ing, drying, oiling and rust prevention, care of equipment, mixing of parts, contamination of abrasive, and choice of equipment and facilities. For your copy, use Reader Service Card.

L—675. Preparation of Aluminum for Spot Welding—A thoroughgoing discussion of efficient methods for chemical preparation of aluminum for spot welding is provided in an 18-page booklet recently published by Oakite Products, Inc., 140 Thames St., New York 6, N. Y.

After stressing the importance of oil-free, uniformly-low-resistance surfaces for quality welds, the booklet supplies specific recommendations of materials, procedures and equipment for (1) cleaning, (2) deoxidizing, (3) rinsing, and (4) drying. These recommendations are said to be based on actual, successful experience in hundreds of industrial installations. Detailed information is also supplied on solution concentrations and temperatures and on immersion time schedules for deoxidizing aluminum alloys of various gauges. Of interest, too, is a section on devices which simplify the determination of solution strength and temperatures. For your copy, use Reader Service Card.

L—676. Caustic Soda—Pennsylvania Salt Manufacturing Company has issued a Caustic Soda bulletin. Divided into four sections under tabbed headings, the booklet provides handy reference for particular problems in purchasing; handling and storage; equipment design; and technical data. Among the latter are charts and tables showing freezing point, specific gravity at various temperatures, NaOH content and density, and other properties. For your copy, write on company letterhead to Pennsalt Chemicals, 1000 Widener Building, Philadelphia 7, Pa., and mention PLATING.

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Alkaline Pre-Soak Non-Electrolytic Cleaning Compounds

Constant and continued use of PERMAG by Platers for 28 years is evidence that it does the cleaning job best.

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PURPOSE
a. Used to remove heavy soil contamination.
b. Used to produce chemically clean surface without current.

REQUIREMENTS
a. Should have long life under heavy contaminating conditions.
b. Should not create surface difficulties.
c. Should operate under a wide range of physical conditions.

CONSIDERATIONS FOR SELECTION
a. Relative strength for metal to be cleaned.
b. Speed of cleaning.
c. Specific results for operation to follow.

Second in a series for Card Index Files on Metal Cleaning with PERMAG. A new Card each month will have a special item.

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50 Court St. Brooklyn 2, N. Y.
In Canada: Canadian PERMAG Products Ltd., Montreal, P. Q.

L—677. Aluminum Etching Compound—Metal Industries Department, The Diversey Corporation, 1820 Roscoe St., Chicago 13, Ill., has published a 4-page technical Bulletin No. 51A on Aluminux, an alkaline etching compound for all aluminum alloys that is said to eliminate cement-like scale formation on tank and coils. It is also said to produce a finer, more even-appearing etch in shorter etching cycles. The solution is chemically controlled to extend bath life.

The bulletin, printed in blue and silver, is designed as a permanent file folder with raised index tab for ready reference. In addition to data on properties and characteristics of Aluminux, it contains a number of illustrated case histories attesting to the advantages of the product. For your copy, use Reader Service Card.

L—678. Packaged Electric Power—A new 24-page bulletin GEA-5600 on packaged electric power is now available from the General Electric Company, Schenectady 5, New York.

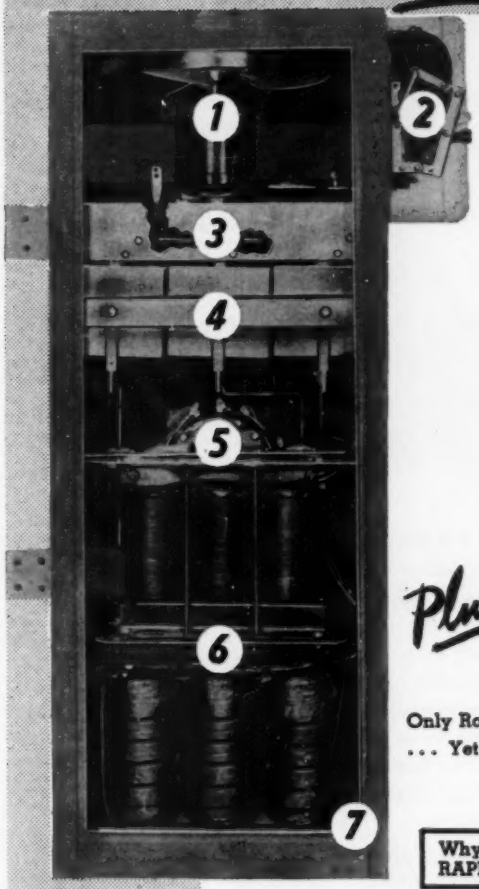
Use of packaged electrical systems is said to simplify plant-engineering problems, cut equipment and installation costs, conserve vital materials and manpower, and insure quicker delivery of electrical equipment, according to the bulletin. The net result, explained in 52 photographs and diagrams, is a safer, more flexible, more dependable, more economical and more efficient electrical system.

This new publication also offers a list of 31 other G-E bulletins giving full information on available equipment for industrial-power expansion. For your copy, use Reader Service Card.

L—679. Aluminum Paint—Technical Bulletin Sheet 025 describes Prufcoat Aluminum, a product of Prufcoat Laboratories, Inc., 63 Main St., Cambridge, Mass. A ready-mixed, all-purpose paint for use inside or outside., it is based on what is said to be a chemical-proof, crystal-clear vehicle. For your copy, use Reader Service Card.

L—680. Polyethylene Tank Liners, Piping, etc.—American Agile Corporation, Plastics Division, 5806 Hough Ave., Cleveland 3, Ohio, offers two 8-page illustrated folders. One sets forth the mechani-

Will the next rectifier you buy have these 8 important features?



1. **Updraft ventilating system.** All displaced air moves across the stacks — no wasted capacity. Totally enclosed ball-bearing motor needs practically no servicing.
2. **Magnetic starter** with built-in overload and single-phasing protective relays. No fuses to replace.
3. **Thermal relay** shuts rectifier down at once if stack overheats — positive protection in case of prolonged overload or a ventilation failure.
4. **Double-tested International Rectifier stacks,** checked once by the manufacturer, again by us before assembly. Generous stack area permits full load operation at temperatures as high as 110° F.
5. **Non-interrupting output regulator,** with single-knob full-range control, continuous power while adjustments of voltage are being made.
6. **Heavy-duty transformers,** Class B-construction, with non-inflammable, corrosion- and fungus-proof insulation. Operate at full load without forced draft. Vacuum-impregnated for unlimited life.
7. **All-steel welded cabinet,** corrosion-proofed inside and out, attractively finished.

Plus

8. An exhaustive operating "shakedown" trial before shipment, during which the most modern test equipment is used to check every detail of construction and performance.

Only Rapid Electric rectifiers give you all eight of these features . . . Yet prices are surprisingly low — deliveries prompt.

Why not find out more about RAPID rectifiers right now?

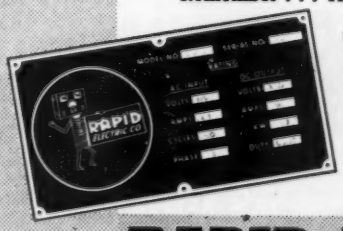
DO YOU HAVE OUR NEW CATALOG?

Packed with useful information, this easy-to-consult new booklet describes our wide variety of stock models.

It explains and describes, too, our latest automatic equipment for periodic reverse current plating, as well as numerous other controls to improve the quality and lower the costs of your metal finishing operations.

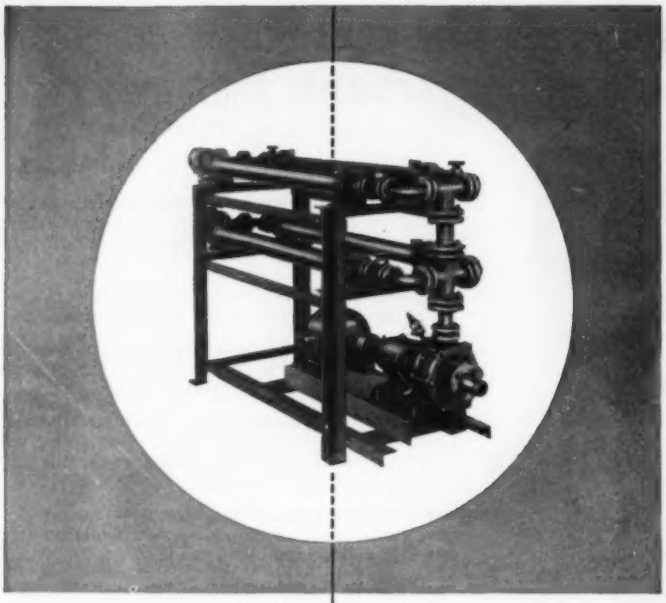
WRITE TODAY FOR BULLETIN RP-51

Remember . . . This Nameplate Means



"More Power to You"

RAPID ELECTRIC COMPANY
2881 MIDDLETOWN ROAD, N. Y. 61, N. Y.



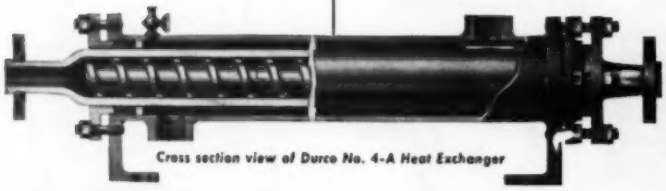
A highly corrosion resistant heat exchanger in a

READILY AVAILABLE ALLOY*

The **DURCO** No. 4-A Heat Exchanger efficiently heats or cools corrosive plating solutions.

In this exchanger, the corrosive is in contact only with Duriron parts. The units can be installed either horizontally or vertically, with counter or parallel flow, and permit flexibility of grouping for difficult locations.

***DURIRON** is a high silicon iron, resistant to most commercial acids and other corrosives such as nickel plating, copper plating, chrome plating and anodizing solutions.



Cross section view of Durco No. 4-A Heat Exchanger

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

We will send, on request, Bulletin 1610B giving complete details and specifications.

THE DURIRON COMPANY, Inc.
Box 1019, Dayton, Ohio

Trade Literature

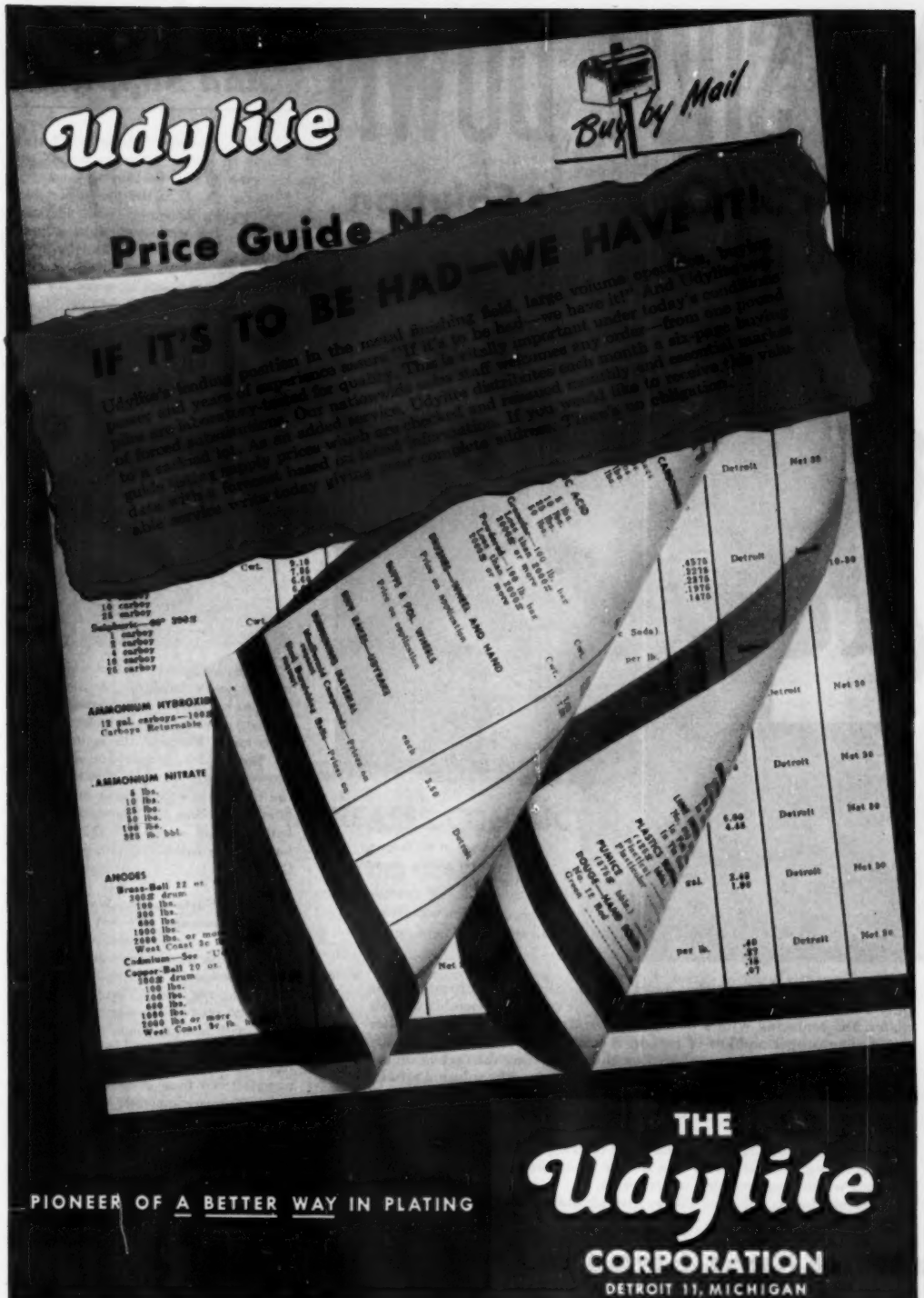
cal, electrical, thermal and chemical-resistance properties of Agilene polyethylene resins, which the company uses to manufacture tank liners and pipe-line assemblies as described in the August issue. The other describes rigid Agilene containers—bottles, jars and jugs—for storage and transportation of corrosive chemicals. For your copies, use Reader Service Card.

L—681. Chemical-Resistant Cement—The Atlas Mineral Products Company, Mertztown, Pa., announces Alfane, a light-colored synthetic-resin cement which, in addition to resistance to most acids, salts, solvents and greases, is said to have excellent resistance to all alkalies. Unlike other resin cements, Alfane sets hard in contact with concrete and metals and exhibits outstanding adhesion properties for jointing brick and tile and adhering glass, concrete, metals and other materials, it is stated. Bulletin 5-30D gives complete details on this new product. For your copy, use Reader Service Card.

L—682. Graphic Arts Plating—The Hanson-VanWinkle-Munning Company, Matawan, N. J., offers a reprint of the article "Engineering for Electroplating in the Graphic Arts", by R. F. Ledford, reprinted from 1950 issues of The Electrotypers & Stereotypers Bulletin. This booklet covers the many details to be considered in the design of a plating tank; the electrical equipment with its effects on related problems; the comparative efficiency of aluminum and copper bus bars, and such other matters as temperature, connections, electrifying a tank, controls, heating and cooling solutions, solution agitation, semiautomatic and full-automatic plating. For your copy, use Reader Service Card.

L—683. Blast Cleaning—Special cleaning problems are discussed by American Wheelabrator & Equipment Corporation, 555 S. Byrkit St., Mishawaka, Ind., in Catalog No. 724, which in its 28 pages depicts the application of airless blast equipment to thirty-nine production problems. The many drawings and installation photographs show principles and actual installations on which case figures are available. For your copy, use Reader Service Card.

L—684. Etching, Lithographing, Plating—Electro Chemical Engraving Company, 1100 Brook Ave., New York 56, N. Y., has issued a 6-page bulletin listing and illustrating its facilities for the above and for embossing, stamping, screening and spray painting of parts varying in size from a miniature watch dial to a yard long panel. For your copy, use Reader Service Card.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THE Udylite CORPORATION
DETROIT 11, MICHIGAN

NO SHUT DOWN

To Carbon Treat Solution with SPARKLER FILTERS

A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

Carbon treatment without shut down is accomplished by cutting out one or two units in a battery of filters, removing the cartridge assembly of filter plates, and replacing with a new plate cartridge dressed with clean filter paper. The proper amount of carbon is mixed with water in a standby tank and recirculated through the filter thus depositing the carbon on the new plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

The quick change feature of the plate cartridge in Sparkler filters permits replacing a set of plates in a matter of minutes. Production can be resumed without appreciable interruption.

Sparkler Horizontal Plate Filters give absolutely sharp filtration at all stages of the cycle.

SPARKLER MANUFACTURING CO.
Mundelein, Illinois
European Plant—Herengracht 568, Amsterdam, Holland

SPARKLER horizontal plate FILTERS

1020 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 929.

Equipment and Supplies

E—758. Portable Plexiglas Plating Barrel—A new development of the Hanson-Van Winkle-Munning Company, Matawan, N. J., is the Mercil portable-type plating apparatus with Plexiglas cylinder. This equipment, which is made with cylinders 6 inches in diameter by 12 inches long and 8 inches in diameter by 18 inches long, is said to enable the user to process small parts efficiently.

The entire unit is light in weight and can be easily handled. A rheostat is included so that the cylinder can be operated at various speeds. Cylinder, legs and gears are of Plexiglas; the motor is 1/15 hp, suitable for operation on a 110- or 220-volt, single-phase, 60-cycle circuit. It can be used in either acid or alkaline solutions, providing the temperature of the bath does not exceed 180–185° F. For further information, use Reader Service Card.

E—759. Surfactants, Waxes—Glyco Products Company, 26 Court St., Brooklyn 2, N. Y., offers (1) non-ionic surface-active agents, used as emulsifiers, stabilizers, dispersants, and penetrating and wetting agents, and (2) synthetic waxes, industrial products having unique properties, with melting points up to 142° C (285° F), which are used as modifiers for resins, natural waxes, etc. The waxes are manufactured from domestic raw materials and replace imported, high-cost natural waxes, in many instances doing a better job, it is said. For further information, use Reader Service Card.

E—760. Treatment of Forming, Stamping and Cutting Oils to Insure Good Cleaning—Magnus Chemical Co., Garwood, N. J., advises that Magnusol, the emulsifiable solvent cleaner that is in extensive use for precleaning metal objects prior to cleaning before plating, can be

FULL LENGTH "CONDUCTA-CORE"
INCREASES CONDUCTIVITY, RIGIDITY

Federated Conducta-Core Lead Anodes have a highly conductive and non-contaminating 3/8" diameter aluminum rod running from top to bottom. This, together with the unique design of the anode, assures complete rigidity . . . there is no curling, buckling or peeling to interfere with automatic plating operations.

The Conducta-Core makes every inch of the anode highly and uniformly conductive . . . more current can be carried than by ordinary anodes. Another advantage of the Conducta-Core Anode is the great number of high projections that give it greater-than-average throwing power.

No need to worry about anodes dropping into the tank because of corroded hooks . . . an improved lead coating 3/16" thick at the base of the copper hook is your guarantee of permanently attached anodes.

Federated Conducta-Core Anodes are available in all standard lengths up to 52 inches, and with a variety of hooks. Special sizes made to order. Flat Rolled and 3-Rib Lead Anodes can also be supplied.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

Mutual

CHROMIC ACID

OTHER NAMES: Chromic Anhydride, Chromium Trioxide
FORMULA: CrO_3
MOLECULAR WEIGHT: 100.01
DESCRIPTION: Deliquescent, dark red flakes. Bulk density averages 105 lb. per cu. ft.

CrO_3	99.75% min.
Chloride as Cl	0.01% max.
Sulfate as SO_4	0.1% max.
Insoluble in water	0.01% max.

USES: Chromium plating. Anodizing of aluminum. Metal surface treatment, including cleaning, pickling, etching, coloring and improvement of corrosion resistance and paint adherence. Pigment manufacturing. Organic oxidation syntheses, as in the production of dyestuffs and pharmaceuticals. Manufacturing other chromium chemicals and catalysts.
SHIPPING CONTAINERS: Steel Drums—100 lb. net.

OTHER MUTUAL PRODUCTS

Sodium Bichromate — Sodium Chromate
Potassium Bichromate — Potassium Chromate
Ammonium Bichromate

MUTUAL CHEMICAL COMPANY OF AMERICA

270 Madison Avenue — New York 16, N. Y.

SINCE 1845

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 931.

EXPECT THE BEST FROM TRUE BRITE

TRUE BRITE can now help your shortages of copper cyanide by concentrated solution of the double salts of sodium cyanide and copper cyanide. Reasonable prices and good materials are assured. Immediate delivery not assured, but attention will be given requests for information.

We also expect to have TRUE BRITE BRASS MAINTENANCE COMPOUND available in a concentrated liquid form and Makeup solutions for conventional brass plating. Write for information.

We still manufacture TRUE BRITE NICKEL BRIGHTENER and have plenty for immediate shipment. Still the best and most suited for subsequent chromium plating.

The TRUE INSULATOR is your best bet to insulate your steam and water lines from stray currents. Now available in ½, ¾, 1 and 1¼ inch sizes. Prompt delivery.

TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box 31, Oakville, Conn.

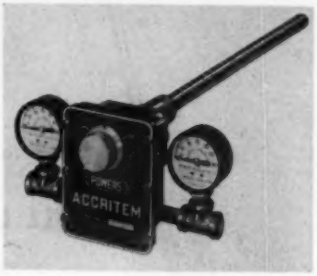
Practical Products for Practical People

Equipment and Supplies

used as an additive to the forming, cutting and stamping oils to act as insurance that the existing cleaning method will continue to do the job expected of it, regardless of any changes made in the formula of the lubricating compounds.

Proportions of Magnusol used may vary somewhat with the oil used, but experience indicates that 1 part Magnusol to 6 parts of the oil will be adequate in most cases. The Magnusol has no effect on the lubricating qualities of the oils, and it is compatible with all types of cleaning agents, so that its only effect is to provide an added cleaning action. . For further information, use Reader Service Card.

E—761. Temperature Regulator—The Powers Regulator Company, 3501 Oakton St., Skokie, Ill., offers the Accritem Temperature Regulator, an expansion-stem-type regulator used to maintain liquids or air at any temperature desired by controlling pneumatic- or water-operated diaphragm valves or dampers.



Features include simple, rugged construction that is said to withstand vibration and insure many years of reliable service. It has adjustable sensitivity and overheat protection, calibrated dial-temperature adjustment, and temperature ranges of 50–250°F and 150–350°F. Easy to install at point where temperature is to be controlled, it requires compressed air or water at 15 psi pressure. The regulator head is 2-⅞ x 3-⅝ inches; the sensitive bulb, 12 inches long with ½-inch I.P.S. connection. The sensitive element is an Invar rod enclosed by a silver-soldered copper bulb. Bulb wells of corrosion resistant metals are available. For further information, use Reader Service Card.

E—762. Electrostatic Paint Spraying—Ashdee Products, Inc., 18029 Dixie Highway, Homewood, Ill., offers a new electronic accessory for paint-spray units. It is known as the "Paint-Miser", and operates on the electrostatic-attraction principle to precipitate up to 95 per cent of the paint spray on the work. This is accomplished by establishing a negative

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 932.

HD-N

Cuts Cleaning Time

Cowles HD-N Cleaner, the *new* heavy-duty soak cleaner for ferrous metals, will often do in 10 minutes what it takes other cleaners 30 minutes or more to do. It is specifically formulated as a straight or barrel soak for precleaning before plating, enameling, pickling, painting, back-shop reconditioning—or anywhere a heavy-duty cleaner is needed to remove stubborn types of soil.

The latest developments in metal cleaning research have been incorporated in HD-N to assure maximum detergency under all conditions of usage.

HD-N may also be used on such active metals as brass and zinc, if some attack is acceptable.

HD-N penetrates and removes such soils as oil, carbon, grease, drawing compound, graphite, road and shop dirt in *one* cleaning operation. It is fast, thorough, and does a complete job . . . is readily and completely soluble in hot water.

COWLES CHEMICAL COMPANY
Metal Cleaner Department
7016 Euclid Avenue • Cleveland 3, Ohio

This booklet will be sent by filling in coupon.

Cowles Chemical Company
7016 Euclid Avenue
Cleveland 3, Ohio

Please send me booklet, "HEAVY DUTY CLEANING THE FAST WAY."

Name_____

Company_____

Address_____

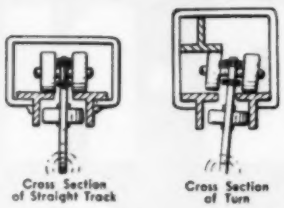
City_____ Zone____ State_____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 933.

Equipment and Supplies

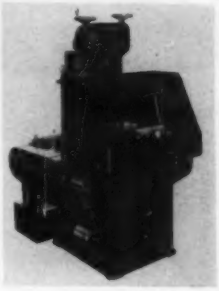
charge in the paint particles as they leave the spray gun. The paint spray is then attracted to the item to be coated, which is at ground potential. With this method, spraying from one fixed position is said to allow the paint spray to reach around corners, cover top, bottom and hard-to-get-at-places with a smooth, uniform coating. For further information, use Reader Service Card.

E—763. Flexible Overhead Conveyor—Shuler Conveyors, Inc., 43 Hutcheson Pl., Lynbrook, N. Y., has announced an economical overhead conveyor, the "Econ-O-Veyor", which adds many new features to the conventional overhead chain conveyor. For example, the trolleys are on 12-inch centers and are connected by a chain, which makes it possible to hang the load every 12 inches or multiples thereof. Each trolley has three ball-bearing wheels, two positioned vertically, to carry the load on two spaced parallel T bars



and a third positioned horizontally between the T bars. With one additional T bar above the outside regular T bar on horizontal turns and two additional T bars above the regular T bars on vertical turns, the chain and trolleys have full rolling contact with the track at all times without the aid of roller or traction wheel turns. The resulting very low chain pull for a given loading reduces power consumption, permits lower-powered installations than before, and increases equipment life. The use of ordinary mill-run T bars for track and the elimination of expensive roller turns has greatly reduced the price of the conveyor. The drive is a caterpillar type of either constant or variable speed as desired. The extreme flexibility of the "Econ-O-Veyor" makes it applicable to almost any job, and prompt deliveries are reported. For further information, use Reader Service Card.

E—761. Abrasive Belt Platen Grinder—Hammond Machinery Builders, Inc., 1613 Douglas Avenue, Kalamazoo, Mich., has added to its abrasive-belt platen-grinder line a heavy-duty 8-inch Wet Abrasive Belt Grinder known as Model



V8-WP. It features a new patented Power Reciprocating Table with Tilting Workholder, and a Water Cooled Belt Platen (patent pending). The machine is designed for production finishing and surfacing of ferrous, ceramic, plastic, and thin ferrous parts. Thin-sectioned parts can be finished without danger of distortion.

Table travel is adjustable from 0 to 8 inches, and the stroke speed back and forth across the abrasive belt can be varied to suit the work. The self-contained coolant system employs 2 coolant tanks with a combined capacity of 35 gals. The Model V8-WP also can be equipped with a plain table or manual reciprocating table, and for water-main connection instead of with self-contained pump and tank unit. For complete information, use Reader Service Card.

E—765. White Brass Plate—A development that may help replace nickel in the automotive and other industries has been announced by the duPont Company's Electrochemicals Department, Wilmington 98, Del. Through it a "white brass" alloy is used as a base for chromium finish. This process is now the subject of intensive research work in the company's laboratories and in manufacturers' plants to adapt it to current production demands. The company emphasized that there are

BLACK MAGIC meets every BLACK OXIDE Specification
GOVERNMENT SPECIFICATIONS
57-0-2C Type 3
51-70-1A Finish 22.04
Aeronautical Material Specification AMS 2485
and all other specifications calling for a black oxide finish.
• Easily blackens heat treated parts.
• One bath! One salt!
• Lower operating temperature.
• Self rectifying.
• Faster blackening cycle.
• More corrosion resistant.

Write for Bulletin MB-3

Send items of your own manufacture for sample processing.

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Sales and Technical Service also available at our Chicago office: 7001 North Clark. Representatives in all leading cities.

Mitchell-Bradford

QUALITY PRODUCTS OF CHEMICAL RESEARCH

still a number of technical obstacles to be overcome.

Preliminary results indicate that chromium, plated over white brass, is indistinguishable in brightness and color from that plated on nickel base. The white brass used in the du Pont process is an 80/20 zinc-copper alloy which is electrodeposited from a cyanide bath using special brightening agents. From there on articles are chromium plated in the usual manner.

E—766. Precoated Metal Coil—Metal coils, precoated in color and precision slit to exact width, trademarked "Enamelstrip", are produced by the Enamelstrip Corporation, 20th and Walnut Sts., Allentown, Pa., and sold through The Coated Coil Corporation, 501-551 W. 30th St., New York City.

It is available in cold-rolled steel, electrogalvanized steel and electrolytic tin plate, brass, zinc and aluminum, in any desired color or shade, coated on one or two sides. High adhesion enables the coil to withstand the stresses of drawing, bending, forming and fabricating without cracking or peeling, and the smooth, lustrous finish is said to be maintained throughout the manufacturing process. It is being successfully used for such items as batteries, appliances, automobile parts and accessories, containers and screw caps, office equipment, marking devices, buttons and buckles, toys, lighting fixtures, instrument parts, novelties and a host of others.

The Enamelstrip Corporation will supply its own metal, coated and slit, or will coat and slit a customer's metal according to individual specifications. Samples of Enamelstrip will be sent on request. For further information, use Reader Service Card.

E—767. Bright Silver Plating—Enley Products, Inc., 254 Pearl St., New York 38, N. Y., is now producing newly developed "Silver Speed Brightener" and "Silver Speed Conducting Salts" in addition to "Silver Speed". These products are not linited to use in new solutions, but are also designed to convert old solutions.

Used in conjunction with the "Silver Speed" reagent, the new brightener is said to produce brighter deposits and to reduce cyanide consumption.

The use of the conducting salts is said to eliminate burning and permits the use of higher current densities than heretofore possible. They can be used with the brightener or alone with the "Silver Speed" reagent; for maximum effect all three may be used together. For further information, use Reader Service Card.

E—768. Emulsion Cleaner—The DuBois Co., 1120 W. Front St., Cincinnati 3, Ohio, announces a ready-to-use emulsion cleaner, Super-Mul. Specifically designed for removal of industrial soils in spray-washing machines, it is said to clean thoroughly, rinse freely, resists hard water, and not to sludge. Other claimed advantages include safety for personnel and materials, no attack on metals and painted surfaces, freedom from objectionable odor, nontoxicity, and a high flash point.

The manufacturer recommends it for metal cleaning in one-stage washers, prior to bonderizing, during processing, and before painting, for precleaning prior to alkaline cleaning and for wipe-down cleaning of equipment and machinery. When used in low concentrations in the rinse, Super-Mul provides interim rust-inhibition. For further information, use Reader Service Card.

E—769. Boiler Replacement—Maith Company, Wood and 6th Sts., Philadelphia 6, Pa., offers to replace oil, gas and coal heating-system boilers at direct-factory prices with savings of 40 per cent. For further information, use Reader Service Card.

THIS RACK COATING MEANS SAVINGS

UNICHROME COATING 218X *helps conserve time, labor and materials*

■ With today's shortages, restrictions and high operating costs, it pays more than ever to give your racks the protection of Unichrome Coating 218X. You'll be able to work racks longer, harder in all plating cycles—and cut costs and waste besides. Here's why:

This green baked-on plastisol coating has *flexibility, body, chemical inertness* and remarkable *toughness*. With only a *single* time-saving application of Unichrome Primer 219PX, you assure outstanding adhesion of the chip- and scuff-resistant Coating 218X in strongest plating baths and cleaners—vapor degreasing cycles included. Its proved ability to maintain a smooth, free-rinsing surface, free from damage and blisters, not only means less maintenance, but also less contamination of vital plating solutions by drag-in and less waste by drag-out.

To cut expenses, use Unichrome Coating 218X on all your racks. You can easily apply it yourself, or can have a nearby qualified applicator do it for you. We'll send you names. Write us.

UNICHROME Trade Mark **COATINGS for METALS**

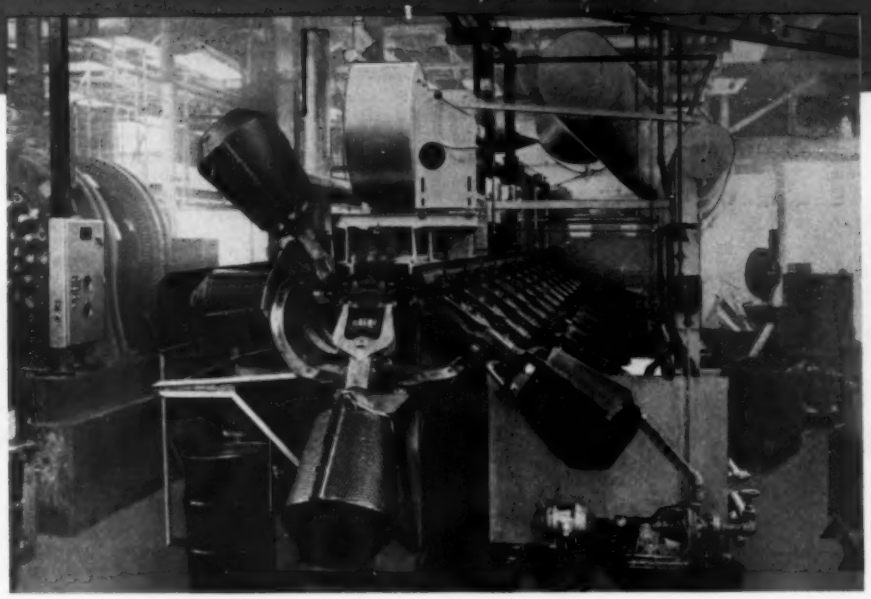
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N. Y. • Detroit 20, Mich. • Waterbury 20, Conn. • Chicago 4, Ill. Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto, Ont.

Presenting

THE NEW STEVENS SUPER "E" FULL AUTOMATIC BARREL PLATING MACHINE



Imagine one man processing 16,000 pounds in eight hours! That is what this new Stevens plating machine can do for you. Like the famous Stevens Model "C," the new Super "E" Model can be used for Cleaning, Pickling, Plating and Drying—and it will automatically unload the processed parts. All you do is load it manually or automatically.

Designed primarily for the plating and finishing of bulky metal parts in large volume, the Stevens Super "E" will bring important savings to your operations. Low cost per piece or pound is immediately evidenced. Both the Stevens Super "E" and smaller Model "C" are the only full automatic barrel plating machines on the market today.

If your production involves plating or finishing of bulky metal parts in volume, it will pay you to investigate this new Stevens Super "E" Model. Ask your Stevens representative for details or write to *Frederic B. Stevens, Inc., Detroit 16, Michigan.*

Be sure to visit the Frederic B. Stevens exhibit and see this machine in operation at the National Metal Exposition and Congress at Michigan State Fair Grounds in Detroit, October 15 through 19, Booths 330, 336 and 342 in Building "D."

METAL FINISHING EQUIPMENT AND SUPPLIES SINCE 1883

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OCTOBER, 1951 VOL. 38, NO. 10

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This month's cover picture shows a spray-rinse tank in a full automatic plating machine, with an electrically controlled spray that comes on as the work enters the tank and goes off as it leaves. From the Rominsky-Clifton convention paper on Rinsing for Electroplating.

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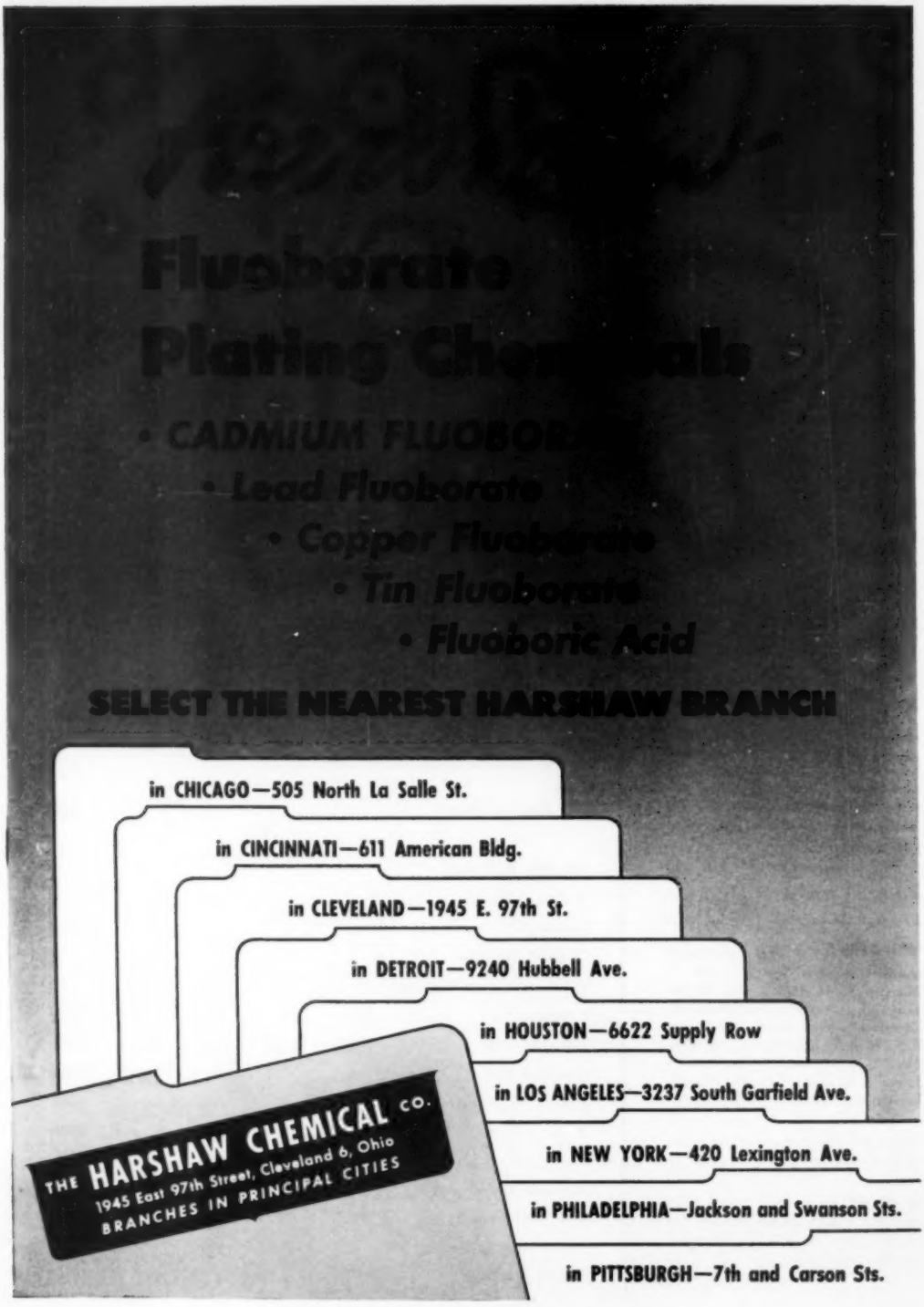
Contents

Substitute Finishes for Electroplating
- Phosphate Coatings 1030
  Alfred Douty
- Chromate Treatments 1033
  Charles W. Ostrander
- Black Oxide Coatings on Metals 1036
  Walter R. Meyer
- Organic Coatings in Today's Metal Finishing 1037
  Donald R. Meserve
- Rust Preventives—A General Survey 1047
  Arnold W. Ackerman

Abstracts of Convention Papers 1040
Chicago—Host City for 1952 Convention 1052
We Yearn to Learn—Continue A. E. S. Wives in 1951 1054
Francis M. Hoffman
Branch Speakers List—A Correction 1054
Porosity of Electrodeposited Metals: X. Hydrogen Content of Electrodeposited Metals 1055
N. Thon, D. G. Kelemen and Ling Yang
Washington Orders 1058

Monthly Features

Industry News 998
Personals 1006
Trade Literature 1014
Equipment and Supplies 1020
Editorial 1029
Book Review 1060
Question Box 1062
Patent Abstracts 1064
A. E. S. News 1080
Branch News 1082
Membership Report 1089
A. E. S. Directory 1090
Advertising Index 1093
Future Meetings 1094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Editorial

Substitutes?

THE AUTHORS of two of the five papers on Substitute Finishes for Electroplating published in this issue point out that previously substitutes have remained in use after the emergency has passed. That observation is important, because most of us have looked down upon the substitute—the word does derive from a Latin expression meaning standing below—and perhaps have not given it the chance it deserves.

The English language is marvellously rich in synonyms, but we do not always realize that each has its own, slightly different meaning. Among the synonyms for "substitute" are "makeshift" and "stopgap", both of which have derogatory implications. Others are "resource" and "expedient", which do not suggest disparagement.

There is no question but that some substitute finishes are inferior in many applications to those that they have replaced, and serve as makeshifts only. Others may prove to be hitherto untapped resources, and should be looked upon as expedients that may remain such for years to come.

Those interested in promoting today's substitutes will doubtlessly try to improve them and make them better able to compete when the present exigency ceases, and they will be helped by those who have spent money on making the change. There is a natural disposition among people to stop development work on materials that have become temporarily unavailable. That course, however, is very dangerous; they may find themselves in a much weakened position when conditions return to normal.

In the meantime, it behooves all of us to make the best of what we have in order that the plating industry retain its position.

Gustaf Soderberg

SUBSTITUTE FINISHES FOR ELECTROPLATING

The papers introducing the Open Forum on Substitute Finishes for Electroplating, organized by A. E. S. Executive Secretary Dr. A. Kenneth Graham and presented at the recent Buffalo Convention, are reproduced here to meet the demand for information on this timely subject. It is hoped to publish in an early issue also the general discussion which followed the presentation of these papers.

PHOSPHATE COATINGS

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Introduction

It is difficult for those who have worked for years in the field of conversion coatings on metals to adjust themselves to the point of view that there are substitutes for electroplated finishes. The word "substitute" often implies some kind of inferiority, and this term in turn involves subjective as well as objective factors. Perhaps objectivity may be advanced by listing a few of the reasons for applying electroplated coatings on the one hand and phosphate coatings on the other. The order of the listing is surely arbitrary, but an attempt has been made to put the most common objectives near the top and the least common near the bottom of each list.

Some reasons for applying electroplating

Decoration
Corrosion retardation, alone
Corrosion retardation, under supplementary organic coatings only
Corrosion retardation, under phosphate coatings *and* supplementary organic coatings
Electroforming, repairs to worn machine parts
Wear resistance—bearings, pistons, et cetera
Aid to drawing—copper on wire, et cetera
Increase in surface electrical conductivity as in radar parts

Some reasons for applying phosphate coatings

Corrosion retardation, under paint or the like
Corrosion retardation, over electroplating and under paint
Corrosion retardation, with aid of oily or waxy supplemental coatings
Wear resistance—cam shafts, piston rings, valve tappets, gears, et cetera
Aid to drawing or forming—wire, tubing, flat polished steel for bumpers, et cetera
Corrosion retardation, dry coating, no supplemental organic film
Electrical insulation—transformer laminations, iron powder for magnetic cores
Decoration, colored or dyed phosphate coatings

The lists indicate that there are many objectives common to the two techniques, a few which are specific to each, and several in which they are complementary. Moreover, even objectives which appear to be common to the two arts are often much more frequently obtained by one than by the other.

TABLE I. PHOSPHATE COATINGS FOR STEEL AND IRON

Type of Surface	Cold-rolled, stampings	Cast, forged, hot-rolled	Cast iron, cast steel	Cold-rolled, stampings
General Form and Examples of Products	Automobile bodies, refrigerators	Hardware, nuts, bolts, guns, cartridge clips, etc.	Small arms components, nuts, bolts, etc.	Stampings for cabinets, metal furniture
Supplementary Treatment	Painting	Protective oils, waxes, etc.*	Protective oils, waxes, etc.*	Painting
Type of Coating	Zinc phosphate†‡	Zinc phosphate	Manganese phosphate‡¶	Iron phosphate
Available Methods of Application	Power spray washing, dipping, hand brushing or spraying	Dipping, barrel tumbling	Dipping, barrel tumbling	Power spray washing
Coating Weight mg/ft²	100–600	1000–4000	1000–4000	30–100
Usual Coating Time, min	Power spraying 1–2, dipping 2–5, hand brushing 2–5	20–30	15–30	2–3
Typical Government Specification Applying	USA57–0–2, Type II, Class C. JAN–C–490, Grade 1	USA57–0–2, Type II, Class B	USA57–0–2, Type II, Class A	None
Salt Spray Resistance Required or Expected, hr	250 with specified paint	2 bare§, 36 with rust-preventive	1 bare§, 24 with rust-preventive	150–500 painted, depending on paint

*These coatings, especially the zinc phosphate, are occasionally relied on for corrosion resistance unprotected by oil, etc.

†Zinc phosphate coatings of coating weights 200 to 800 mg/ft², applied by means of power spray washing or dipping have been used successfully as *aids to drawing* of wire, tubing, partly formed pressed objects such as shells, etc., in the forming of flat-polished auto bumper stock, etc. Wire has been drawn "wet" or dry, and dried soap-type lubricants have been used over the phosphate coating.

‡Zinc phosphate coatings have been used as *insulation* between laminations in transformers and other electromagnetic equipment. Core powder for similar use is also so coated.

¶This type of coating is the only phosphate coating used extensively to impart increased *wear resistance* to ferrous-metal bearing surfaces. It is used regularly on piston rings, cam shafts, valve tappets, gears, universal-joint parts, gun-lock parts, etc.

§These coatings, properly prepared and rinsed and bearing suitable protective oils, waxes, etc., will withstand considerably more than the specified salt-spray hours.

Decoration, for example, is a very common peacetime purpose of electroplating. Although proprietary methods of coloring phosphate coatings are available, the use of these processes up to the present time is not nearly as extensive as the use of plating for decorative purposes. As another example, plated metal coatings are relatively infrequently painted for corrosion retardation, but phosphate coatings find perhaps their most important application as a base for paint.

Types of Phosphate Coatings and Their Uses

No attempt will be made to enumerate the situations in which the user of electroplating processes may be required, because of governmental regulation, to seek substitute procedures. The major purpose of this outline is, of course, to afford the plater at least a preliminary basis for the comparative evaluation of available types of phosphate coating for particular applications.

Accordingly, information relating to the types of phosphate coatings recommended for various metal surfaces is presented in Tables I–III.

In addition to the tabulated information, a few general statements involving the selection of phosphate coatings for iron, steel, zinc, cadmium or aluminum may be in order.

1. Under good organic finishes, the phosphate coating need not be thick or heavy to achieve optimum resistance to corrosion. In fact, heavy coatings because of their absorptive nature are difficult to rinse free of soluble matter. Residual soluble matter may well lead to blistering of the paint under very humid conditions. Zinc phosphate coatings used as paint base rarely exceed 500 mg/ft² (54 mg/dm²).

TABLE II. PHOSPHATE COATINGS FOR ZINC AND CADMIUM

Type of Surface, General Form and Examples	Galvanized steel or heavily cadmium-plated steel, erected structures, signs, buildings, truck bodies	Zinc or cadmium electroplate, especially when thin, zinc base die-castings, zinc surfaces of any form, plated small parts, continuous strip
Supplementary Treatments	Painting	Painting
Type of Coating	Zinc phosphate*	Zinc phosphate†
Available Methods of Application	Hand brushing or spraying, brief dipping followed by delay before rinsing	Power spray washing, dipping
Coating Weight, mg/ft²	200–600	75–500
Usual Coating Time, min	2–15, including delay before rinsing	0.5–2.0
Typical Government Specifications Applying‡	AN-F-20 USA72-53	AN-F-20 USA72-53

*This type of coating is formed by reaction of a film of solution with the surface during the delay before rinsing. It is intended particularly for large or relatively immovable pieces which are not readily dipped in a tank or carried on a conveyor.

†This type of coating has also been used as an aid in the drawing of galvanized wire.

‡Both coating types described here are specified for use under paint. The life of paint over zinc exposed to the weather is greatly improved by these coatings for reasons of (a) prevention of spread of underfilm corrosion; (b) prevention of impairment of paint bond because of reaction of alkaline zinc-corrosion products with the finish, a reaction which otherwise frequently results in paint flaking off of zinc surfaces.

General Note: Salt-spray hours are not specified, but they should exceed the hours of resistance for steel under similar coatings.

TABLE III. PHOSPHATE COATINGS FOR ALUMINUM AND ITS ALLOYS

Type of Surface, General Form, and Examples of Products	Wrought aluminum alloys, sheet metal stampings, truck bodies, aluminum tiles	Wrought or cast aluminum alloys, any continuous strip, aircraft parts, automotive parts
Supplementary Treatment	Painting	Painting or none
Type of Coating	Zinc phosphate, crystalline*	Aluminum-chromium phosphate, amorphous†
Methods of Application	Power spray washing, dipping	Power spray washing, dipping, manual brushing or spraying
Coating Weight, mg/ft²	100–300	100–250
Usual Coating Time, min	1–3	1/3–2
Typical Government Specifications	.....	MIL-C-5541 MIL-S-5002 AN-F-20
Salt Spray Resistance Required or Expected, hr	.....	168 unpainted, 500 with specified paint system

*The process is designed to furnish crystalline zinc-phosphate coatings, somewhat similar to those used on sheet steel, for paint bonding purposes. It is possible to process several different kinds of metal in the same solution.

†This type of coating affords superlative paint-bonding and enormously increased organic-finish life. It is also suited to resist corrosion without supplementary coatings. There are several modifications of this process for use by different methods of application and particularly adapted for different services.

2. The necessity for achieving a high gloss without excessive consumption of paint likewise limits the maximum phosphate coating weight to be applied. Steel stampings for automobiles, refrigerators, et cetera, usually have zinc phosphate coatings in the range 150–300 mg/ft² (16–32 mg/dm²). Even thinner iron-phosphate coatings are sometimes used.

3. Metal which is to be deformed after paint has been applied over a phosphate coating should also bear thin phosphate coatings, 40–100 mg/ft² (4.3–10.8 mg/dm²).

4. The heavier zinc phosphate coatings, up to 4000 mg/ft² (430 mg/dm²) are particularly adapted for use on relatively rigid objects which are to be additionally protected from corrosion by supplementary films of oily or waxy rust preventives, not paint.

5. For friction surfaces or for surfaces which may reach moderately elevated temperatures in service or which are to be subjected to the action of alkaline environment, manganese phosphate coatings are preferred to zinc phosphate.

6. Phosphate coatings which are to be used for corrosion protection are, in general, applied by processes which include a final rinsing in solutions of extremely dilute uncontaminated chromic acid with or without phosphoric acid. This final rinsing is essential to assure maximum corrosion resistance of the overall finish and particularly to minimize the tendency of applied paint films to blister under conditions of high humidity.

CHROMATE TREATMENTS

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Introduction

Chromate conversion coatings for protection against corrosion rose to prominence during World War II, when they were especially developed to provide paint adhesion and corrosion resistance on military materiel shipped overseas to the hot, humid battle zones. After the war, many manufacturers began to explore the possibilities of using these finishes on civilian goods and found that they performed very satisfactorily. Thus, a war-born development actually provided a whole new series of processes for the metal finishing industry, and today they are used on practically any product made of or coated with zinc, cadmium, or aluminum.

The coatings are applied by a simple chemical dip or, in some cases, by an electrolytic bath. They can be applied to parts individually or in bulk and provide equally good results from manual, semi- or full-automatic finishing.

For a survey of the field of chromate finishing on civilian goods during a period of material shortages, the present situation offers a wide range of possibilities. With nickel, tin and cadmium no longer available for civilian use and chromium of dubious value without the intermediary nickel plate, and with aluminum sharply cut back, zinc plus a chromate film offers the most practical solution to the bright-plating problem.

Zinc as a protective metallic finish affords excellent galvanic protection to iron, and it is also widely used as a cast metal. However, the development of voluminous white corrosion products under certain exposure conditions renders it very undesirable from a functional as well as esthetic point of view. It is under these corrosive conditions that chromate films have proved to be of the greatest value by retarding the formation of corrosion products. The degree of corrosion protection is dependent, of course, upon the type of surface treated and the type of chromate film used.

The basic characteristics of chromate solutions and films are presented in a nontechnical fashion in the following catechism.

Important Characteristics of Chromate Solutions and Coatings

To what metals can chromate finishes be applied?

a. Zinc plate, zinc-base castings, galvanized steel
b. Cadmium plate
c. Aluminum
d. Copper and brass, to some extent

Why use a chromate conversion film?

a. To protect against corrosion, particularly in high-humidity or salt-mist atmospheres
b. To impart desired surface appearance
c. To improve the bond to an organic finish

What procedure is necessary to produce a chromate film?

a. Clean in alkaline or acidic solution as recommended for the particular metal involved
b. Rinse
c. Dip in acidified chromate solution
d. Rinse thoroughly
e. Where desired, bleach to produce a clear bright surface
f. Rinse thoroughly
g. Dry

What are the important factors in preparation for chromate treatment?

a. Metal surface must be free from oils, grease and oxides.
b. For plated work, a plate thickness of 0.0002 inch (5 μ) minimum is desirable. Salt-spray protection to white corrosion of zinc when chromated increases with plate thickness up to about 0.0007 inch (18 μ).
c. Metal free from impurities provides best protection against corrosion.
d. Thorough rinsing before and after chromating is very important and cannot be over-emphasized.

What are the general characteristics of chromate solutions?

a. Aqueous acidic chromate solutions consisting substantially of chromic acid or bichromate plus other active radicals for chemical or electrochemical treatment
b. Chromate films are formed by immersion of metals in these solutions. As metal is dissolved, a gel-like conversion film precipitates on the surface.

What are the general characteristics of chromate films?

a. Trivalent and hexavalent chromium are the basic constituents of a chromate film.
b. Thin clear films contain mostly trivalent chromium. Heavier yellow films contain both trivalent and hexavalent chromium, the latter being rather soluble in aqueous solutions. Olive-drab films are similar to yellow films but the hexavalent chromium is released more slowly under the same exposure conditions.
c. Abrasion resistance, particularly for heavy yellow and olive drab films, is poor while they are still wet, but improves greatly upon drying.
d. Final hot rinse of heavy yellow and olive drab films above 150° F (65° C) should be avoided, unless a dull finish is acceptable or desired. Clear bright films can be rinsed at temperatures up to boiling, but lose protective value on prolonged immersion owing to leaching effects. Limiting the final rinse to an in-and-out dip to facilitate drying is preferable.
e. Aging films 12–24 hr at room temperature increases the reproducibility of results of subsequent accelerated tests.
f. Baking or dehydrating unpainted films above 200° F (93° C) greatly decreases the protective value in salt-spray or humidity tests.
g. Baking after application of an organic finish has no effect on the protective value.
h. Metal-joining methods are affected as follows by the presence of chromate films:
Soldering of all films on zinc is difficult with rosin fluxes because of the non-wetting characteristics of the film and lack of metal-to-metal contact. This can be overcome by breaking through the film with acid fluxes, abrasion or high solder temperatures. Clear films on cadmium provide good solderability even after prolonged storage, but the other films on cadmium behave the same as those on zinc.
Spot or seam welding on chromated zinc can be accomplished by use of higher amperage or abrasion of the area to be welded. Aluminum coated with a chromate film can be welded without difficulty by the shielded-arc process.
i. Chromate film on zinc and cadmium show but slight resistance to the passage of electrical current even for heavy films such as olive drab where resistances of 1600 microhms/in² at 10,000 psi (250 microhms/cm² at 700 kg/cm²) have been measured. Chromate films on aluminum show unusually low resistance, e. g., 1900 microhms/in² at 100 psi (250 microhms/cm² at 7 kg/cm²).
j. Salt-spray life of chromate films depends on purity, thickness and type of metal treated and on type of chromate film.
k. Outdoor weathering of chromated zinc and cadmium plate in an industrial atmosphere does not show breakdown to white corrosion products. Use of a chromate film affords some increase in protection to red rust.

Types of Chromate Solutions and Their Applications

In Table I the large number of available chromate solutions and coatings have been divided into very simplified groups on the basis of operating *p*H. Doubtlessly there will be other opinions as to some of the information given; however, the information is intended to be descriptive of actual production rather than laboratory evaluation.

When one considers some of the present applications of chromate films, *the first group*, which includes the chemical polishing solutions, is probably the most valuable and widely used for civilian applications. It provides zinc plate with the clear, highly lustrous surface that has long been associated with quality by the public and closely resembles chromium plate in appearance. The results of this treatment are greatly enhanced by smooth or polished base metal and dense bright deposits of cyanide-zinc plate. The addition of a clear organic finish to the chromated surface will increase the resistance of the surface to abrasion. The many bright dips available afford a broad range of application, operation and cost. Finishes of this group have found wide application in the field of electronic equipment on such items as radio and television chassis and speaker units, home utilities, automobile, motorcycle and bicycle parts, office machines, tubular furniture, hand tools, hardware, nuts and bolts, wire goods and plated strip.

Clear bright coatings on cadmium reduce oxidation during storage, provide a surface which can be easily soldered with rosin fluxes, and have found considerable application in the electronics field.

The second group of solutions used produces colored films on zinc and cadmium which generally provide maximum protection against corrosion. Simplicity of operation, broad range of appearances

TABLE I. DATA SHEET FOR CHROMATE CONVERSION SOLUTIONS AND COATINGS

Type	Operation	Color	Basis Metal	Operating Temperature ° F	Immersion Time sec	Salt Spray Resistance* hr
TYPE I—Simple-dip chemical polishing solutions operating at a *p*H range of 0.0 (or less)–1.5, producing lustrous clear to light iridescent yellow coatings of medium corrosion resistance.						
I–1	One dip	Clear to blue tint	Zinc and cadmium plate	70–100	5–20 (up to 60)	24–100
I–2	One dip	Iridescent yellow	Zinc and cadmium plate, galvanized steel, zinc castings	70–100	5–20	100–200
I–2A	One dip plus acid or alkaline bleach dip	Clear to blue tint, iridescent	Zinc and cadmium plate, some galvanized steel, zinc castings	70–100	5–20	24–100
TYPE II—One-dip nonpolishing solutions operating at a *p*H of 1.0–3.5, producing medium-to-heavy films ranging in color from iridescent yellow to bronze, olive drab and black, generally providing maximum corrosion protection. Films with the exception of black can be dyed with certain alizarine and diazo dyes in colors of red, green, blue and black while still wet during processing.						
II–1	One dip	Iridescent yellow to bronze	Zinc and cadmium plate, galvanized steel, zinc castings, aluminum	60–90	15–45 Aluminum: 10–180	100–200 Aluminum: 150–1000
II–2	One dip	Olive drab	Zinc and cadmium plate, galvanized steel, zinc castings	70–90	15–45	100–500
II–3	One dip	Black	Zinc plate	60–90	60–300	24–100
TYPE III—Anodic solutions operating at a *p*H of 2.5–6.0 and 5–50 asf, ranging in color from yellow to black.						
III–1	Anodic	Yellow	Zinc plate	70–90	180–300	100–200
III–1A	Anodic, bleached	Clear to slightly iridescent	Zinc plate	70–90	180–300	50–100
III–2	Anodic	Black	Zinc plate	70–90	180–300	50–100 (sealed, 100–200)

*Time to formation of white salts on zinc plate.

and high protective value have made the baths an essential part of zinc finishing. Present uses include diecast parts such as carburetors and fuel pumps as well as zinc and cadmium plated parts, such as nuts, bolts and brackets in the automotive industry, etc. In the home utility field, washing machines, mixers, juicers, dispensers and wire goods provide typical applications. The solutions are also used on office-machine parts, vending machines, display racks, wire screening and on other items too numerous to mention.

The use of a single-dip 100 per cent chromate conversion coating on aluminum is new, and its potentialities are just being developed. It is applicable to wrought, extruded and cast aluminum. A clear unpolished-to-yellow film is formed which is similar in appearance to that produced on zinc and cadmium; and the process is equally flexible in operation. It has the advantage over the electrolytic processes in that no current is necessary, immersion time is shorter, and the equipment is simpler. The film has low electrical resistance, excellent resistance to corrosion and provides an excellent base for paint. This type of coating is finding wide use in the aircraft and electronic industries.

The third group, in which an electric current is used to produce the conversion coating, has been used by the aircraft industry to provide a black finish and by the refrigeration industry to produce clear films.

Some chromate solutions are used to provide a chemically polished surface on copper, brass and bronze, and will form a conversion film offering some protection to staining and a good base for painting.

This covers briefly the field of chromate finishing. It is well to realize that there is no single chromate coating which can be produced on all metals from a single solution and meet all requirements.

Home-made formulations, which were once very popular, are very rapidly giving way to proprietary solutions or compounds. The change is due to the relatively low cost of the proprietary mixes which, because of proper chemical balance, can be operated within reasonably consistent color and protection standards by routine additions of the concentrate to the operating bath. This has greatly increased the active life of the solution with greater ease of maintenance and control.

A prospective user of chromate finishes will do well to consult the technical staff of a manufacturer of chromate finishes for information as to available processes that may be applied to his particular problem.

BLACK OXIDE COATINGS ON METALS

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Introduction

Black oxide coatings are applied to metals for many reasons. Whereas at present they are used as substitute finishes for metals, for years they have been used for other purposes, including low light reflectivity, color contrast, economy of application, high adhesion, reduction of friction, resistance against flaking, and the finishing of parts that must not undergo significant changes in dimension.

Black oxide coatings are applied by several processes, but in most cases they are formed by oxidation of the metals, which include iron, steel, copper, stainless steel, zinc, cadmium and aluminum. The coatings are thin, ranging from 0.00002 to 0.0002 inch (0.5–5 μ), but in some cases, such as stainless steel, aluminum and copper, good corrosion resistance is afforded.

There are other black-coating processes that do not involve the formation of oxide coatings, e. g., sulfide, telluride, platinum, chromate, dyed chromate, arsenic, "black nickel", and graphite coatings. Some of these will be discussed here only briefly.

The purpose of this article is to point out the features of the coatings rather than to outline the specific operating details for the various processes. For full information regarding the processes, the references listed at the end of the paper should be consulted.

Black Coatings on Iron and Steel

Commercial processes for black oxidizing of iron and steel are heat tinting, oxidation in fused nitrate baths, and oxidation in aqueous alkaline oxidizing solutions. Heat tinting at temperatures of 550–600° F (288–315° C) is done chiefly on small objects such as tacks, nails and wire forms, but it is not restricted to them and is used on guns, machine parts, tools, etc. The coatings are very thin, less than 0.00002 inch (0.5 μ), but they have a pleasing blue-black color which dresses up the part. Corrosion resistance is negligible, and the finish should be protected with oil.

Fused nitrate or nitrate-nitrite mixtures have been used for many years for blackening of steel[1]. The coatings are bluish-black and thin, imparting little corrosion resistance to the base metal.

The solutions generally used for blackening steel are aqueous solutions of sodium hydroxide with the addition of nitrates, nitrites, chromates and chlorates. The coatings formed are usually black rather than bluish-black, and their thickness varies greatly with the operating temperature, time of treatment and the type of solution. For example, solutions composed of sodium hydroxide and sodium nitrate will give thin coatings ranging from 0.00002–0.00005 inch (0.5–1.3 μ). If nitrite is added, the baths will produce oxide coatings of greater thickness and wear resistance. The quality of the coating increases with the nitrite concentration. Baths containing chlorate, nitrate and mixtures of nitrate and nitrite are used in many cases because they can be operated at lower temperatures, namely, 285–295° F (141–146° C). Operation in this range, instead of 295–310° F (146–150° C) for simpler baths, is preferable because there are less fumes, spattering and water loss.

The corrosion resistance imparted by oxide coatings formed in alkaline solutions is not high, because the protection is mechanical. It is poorer on high-carbon steels and cast iron than on low-carbon steels. It is best on electrodeposited iron and pure iron where there are no impurities to break the continuity of the coating. Salt atmospheres are very destructive to the coatings, and life in the standard 20 per cent salt-spray test runs from one to several hours when the coating is not protected by oils or waxes. It is important to know this, because in time of shortages there may be a tendency to substitute oxide finishes for zinc or cadmium plate on parts to be exposed to weather and corrosive atmospheres. This should not be done. The coatings are also attacked by most acids.

There has been some confusion regarding the heat resistance of black oxide coatings on steel. Although the coatings are oxides of iron they will not prevent scaling of the surface if it is exposed to temperatures that would ordinarily cause the steel to oxidize or scale. For example, on range tops where temperatures well above 500° F (260° C) may be reached, the oxide coatings would be destroyed.

Processes have been placed on the market in recent years that blacken steel and cast iron at relatively low temperatures, i. e., 200–250° F (93–121° C). In many cases the type of coating formed is not mentioned, but to the author's knowledge all of the processes produce iron sulfide coatings, although it may not always be obvious from the bath composition. The solutions may contain sulfides, thiosulfates, sulfur, sulfites and other compounds that can produce sulfur ions in solution. Such solutions can, in many cases, be used also for blackening stainless steels. Sulfide coatings on steel offer little or no corrosion protection, and in most cases which have been observed, they appear to accelerate corrosion.

Black oxide coatings are produced on stainless steel in several ways. One method involves the use of strong solutions of sulfuric acid to which an oxidizing agent has been added[2]. The process is unpleasant to run and

does not always produce good results. The prevailing method is to immerse the parts in fused sodium dichromate[3] in the temperature range from 730 to 750° F (387–399° C). Black, adherent oxide coatings are formed that have excellent corrosion resistance. Various colors can also be obtained by varying the treating time. Fused nitrate mixtures are also used[4].

Oxide Coatings on Copper

Good oxide coatings can be produced on copper and its alloys by several methods. Solutions containing sodium hydroxide and an oxidizing agent such as chlorite[5], persulfate[6] and aryl sulphone chloramide[7] are most widely employed. The coatings, of black adherent cupric oxide ranging in thickness from 0.00005 to 0.0002 inch (1.3–5 μ), have a velvety appearance, which is changed by wiping or tumbling to a smooth uniform black. They protect the copper in salt atmospheres from 10 to 100 hours and are excellent bases for organic finishes. Similar coatings can also be produced electrolytically by anodic treatment in strong sodium hydroxide solutions[8].

Ammoniacal copper solutions have been used for many years for applying blue-black coatings to brass. The coatings are probably composed of copper oxide, but their nature has never been fully established. They are very thin (about 0.00002 inch or 0.5 μ) and have very little resistance to wear, salt spray and weathering; about 2 hours in the salt spray will usually destroy the coating. Their use is largely where a cheap blue-black finish is wanted that is protected with a clear lacquer.

Oxide coatings on copper alloys should not be exposed to temperatures at which copper normally will oxidize rapidly. Temperatures above 400° F (204° C) will cause the coating to be destroyed, because oxygen will diffuse through the coating and oxidize the underlying copper.

Black Coatings on Zinc and Cadmium

Black coatings on zinc and cadmium are formed by the deposition of metals or oxides from black-nickel, molybdate, and chromate solutions. Black-nickel deposits are hard, shiny, and adherent, but their corrosion resistance is poor. Molybdate coatings are hard, adherent, and fairly resistant to corrosion (about 6 hours in salt spray), but they have surprisingly good weather resistance. Their resistance to high temperatures is poor, and they should not be used at temperatures above 200° F (93° C). Chromate coatings have good resistance to salt spray, fair outdoor weather resistance but only moderate resistance to abrasion and wear. Chromate coatings produced nonelectrolytically are dyed to form coatings with varying degrees of stability to sunlight, depending upon the dyes used.

Black on Aluminum

Black oxide coatings on aluminum are formed by anodizing the work, usually in sulfuric acid baths, and then dyeing the oxide coating thus formed. The coatings are hard and have good weather resistance, but there is danger of the dyes fading. Black coatings have been produced on aluminum with molybdates, permanganate and selenium, but all of the coatings observed have had little durability and poor adhesion.

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ORGANIC COATINGS IN TODAY'S METAL FINISHING

DONALD R. MESERVE

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Introduction

The organic-coating and the plating industries have long worked hand in hand in a joint attempt to produce better decorative and protective finishes for metal. The use of clear lacquers or synthetics to supplement or complement plated finishes is not new. Clear coatings to prevent corrosion of silver plate, brass and copper are familiar examples illustrating how cooperation between the two industries has produced better, longer-lasting finishes. A combination of plating and coating is often required to do a job which neither could do alone.

In this paper a few of the ways in which the coating industry has given the plater an extra "assist" over the rough spots of production requirements in the face of current plating-material restrictions will be described.

The Korean situation threw us into a defense economy that precipitated a shortage of many materials used by the plater in metal finishing operations; consequently, interest in composite finishes, i. e., metal plate plus organic coatings, increased rapidly. It has taken a cooperative "all-out" effort on the part of platers and manufacturers of organic coatings to keep bright metal finishes in existence.

Chromium Protected with Clear Organic Coatings

Governmental restrictions on the use of copper, nickel and brass presented many problems to the automotive, appliance, tubular-furniture, and other industries. Bright-chromium plated trim appeared to be the first that would fall by the wayside; however, the ingenuity of the plater and the versatility of the organic-finish formulator is a tough combination to beat. Bright trim is still being applied to automobiles, refrigerators, and many other items.

Those manufacturers who had long plated chromium wanted to continue to do so. They knew that chromium was not scarce but also realized that with shortages of nickel and copper the chromium itself would be an inadequate finish. Ordinary bright-chromium plate is too thin to protect the base metal against corrosive agents such as air and water. The very nature of chromium precluded its use in applications where the plater had previously depended upon the underlying nickel plate to afford corrosion resistance. When nickel became one of the first governmental-order casualties, some manufacturers began turning out products having chromium plated over copper or chromium directly on steel, brass or zinc alloys. The bright plate looked as good as ever when new, but except under ideal conditions of usage these parts failed rapidly in service. It was soon evident that some other assistance was needed to give protection and maintain the desired brightness. Special clear baking synthetics were necessary to provide hardness, water-whiteness, gloss and adhesion as well as resistance to abrasion, discoloration, humidity, and salt atmospheres.

Long experience in formulating clear coatings to protect lock hardware, metal name plates, structural bronze, refrigerator shelves, chromium-plated steel tape, zinc-plated and clear-dipped ice skates, and many other items assisted considerably in tackling these problems. The casual observer might immediately feel that with such a diversified background of satisfactory materials, the coating formulator should have no real trouble with these new applications. That is true, to a degree, but the casual observer does not realize that in coating chemistry the properties of individual resins are often not additive, and no single resin material could be expected to provide all of the properties desired for these new uses. Vinyl and phenolic resin coatings, for example, are extremely well adapted to the protection of refrigerator shelving where resistance to high humidity and abrasion are required, but no resistance to sunlight is necessary. Phenolic resin coatings are excellent for use over brass or brass-colored finishes where water-whiteness of the coating is not a requisite. The same coatings would not be acceptable as protectives for exterior bright-metal automotive hardware where absolute clarity, water-whiteness and color retention are added to the other specified properties.

Spurred by war and defense demands, resin-research men and technologists have steadily increased the number and variety of synthetic resins available to endow organic coating materials with a multitude of desirable properties. Serious perplexities are created by the very number of these advances inasmuch as the coating formulator has almost limitless possible combinations of resins with which he can work. A careful study of the qualities needed for these new applications soon narrowed the field of resins which could be utilized successfully. Acrylics, alkyd-urea-formaldehyde and melamine-formaldehyde-alkyd resin combinations are those most commonly employed today, because they combine the best available properties for the job at hand.

Interestingly enough, the majority of specifications written for these finishes require them to provide resistance to salt spray, humidity, and other test or evaluation procedures in excess of that previously required of the standard copper-nickel-chromium finish. It was found in many cases that even with all of the new resins available, coatings formulated as long as ten years ago were of sufficient quality to be adopted for immediate production while additional research work on superior products was undertaken. Application of clear baking synthetics by hand spraying, automatic spraying, electrostatic spraying, or dipping is common in production today. Dry film thickness ranges from as little as 0.0005 inch (13 μ) to as high as 0.002 inch (50 μ). Baking schedules vary from 20 to 30 minutes at 250° F (121° C) up to 400° F (204° C) for 7 to 10 minutes.

Experience has shown that these clear coatings have an excellent chance of giving satisfactory performance if the same care is taken in selecting, applying and baking them as has been taken in the past by platers who are doing specification plating. Excellent adhesion of clear enamels to chromium plate can be obtained if the chromium surface is in the proper condition prior to their application. Many variables make it an almost impossible job to describe what is meant by the term "proper condition". It takes into account the brightness of the plate, whether it has been buffed or not, and all of the cleaning procedures used just prior to enameling. Often a final rinse in dilute chromic acid prior to coating is the deciding factor in the ultimate service obtained from the applied synthetic.

Bright Zinc in Place of Chromium

Ways have also been devised to produce a chromium-like appearance without the actual use of chromium. Bright zinc, clear dipped and protected with clear synthetics, is being used. Appearance-wise, this finish often resembles chromium so closely that it will even fool an old hand at the game.

The zinc-finishing system is used primarily on steel and zinc-base diecast parts. The qualities needed in a clear protective for chromium are also needed in this case, although differences in surface structure some-

times occasion minor formulation changes to meet this particular protective problem.

Perhaps the largest usage of the zinc-finishing system is for refrigerator shelving. Almost the entire shelf industry started with this finish at the end of World War II when tin or nickel were still unavailable. More refrigerator shelves have been finished in this manner than any other since that time. In the early stages, some difficulties were encountered, but they were soon traced to poor zinc plating, failure to clear-dip properly, over-thinning, or failure to bake the coating materials properly. Once these errors had been rectified, the finishing procedure was accepted as standard. This finishing system now goes hand in hand with the always present chromium finish.

Tinted Clear Coatings

Scarcities of copper and brass presented the next challenge to the plating and coating industries. Again, chromium plate and bright-zinc plate took a position of prominence, but this time the protective synthetic enamel took on another job. In addition to providing protection, it had to carry tints and colors which would give the finished piece the appearance of rich yellow brass, bronze or copper, as the case might be. Such tinted clear coatings have long been made by the coating manufacturers, but usually they had only a reasonable amount of light stability. Now they must be permanently light-fast. The challenge was met, and such colors are available today and are already in use in large scale production.

Gold, brass, and copper colored clear coatings are being used over bright chromium, bright clear-dipped zinc, polished stainless steel, and polished aluminum. Scrupulous care is required to obtain consistently uniform color. The brightness and color of the base metal must first be the same on each piece, and the application of the tinted enamel must be uniform. Obviously, variations in thickness of the enamel will cause equivalent variations in color intensity. Automatic-spray or electrostatic-spray techniques are most widely used to control these variables as much as possible. Careful inspection practices are required to insure uniformity. Tinted versions of the same clear enamels originally prepared for use over chromium or zinc have been utilized in these cases, and they are being widely adopted in efforts to replace the scarce copper and copper-base alloys formerly employed in a diversified list of industries.

Today's styles have also instituted a new trend in the use of color. Distinctive effects are being produced by the use of transparent blues, greens, and reds applied to bright metal surfaces through the medium of tinted clear enamels. There is every indication that this practice will not only continue, but will, in all probability, expand.

Opaque Pigmented Coatings

During World War II, there was widespread usage of opaque pigmented coatings as substitutes for metallic deposits. Many such coatings contained aluminum or bronze powders to simulate metal-like appearance. The use of such materials is currently being turned to only as a last resort. True, those finishes served their purpose well and still have some applications, but at best they are definitely "substitutes". Consumer resistance to such finishing practices is high for that reason.

General Discussion

As a result of steadily improving quality and the adoption of plating specifications, in which the A. E. S. has played a vital part, the consumer has confidence in plated finishes. Today, he will also accept the alternate combination finishes unless his confidence in them is shaken because of the use of poor materials or good materials poorly applied. These finishes do not appear to be substitutes, and if properly handled their lasting qualities in usage will soon prove their worth. Furthermore, today's alternate finishing procedures allow the plater to continue the use of his equipment, although he may have to expand his facilities to include equipment necessary for applying and baking organic finishes. The plating industry, by continuing to produce to as great an extent as possible with existing equipment, is making a healthy contribution to the defense program. The complete "substitute" finishing procedures mentioned above gave the plater an unwelcome "holiday" when his plating facilities were temporarily abandoned and replaced with new facilities for the application of coating materials only.

In spite of today's shortages, there is evidence to support the belief that manufacturers will still turn out bright metal parts that will look like, serve as well and last as long as those same parts processed prior to shortages. Admittedly, it may be a more troublesome practice in production to start with, but once established it will offer no real problems to maintain product quality. When tin became scarce during World War II, the refrigerator manufacturer was hard hit. Hot-dipped tin had always been used over steel for refrigerator wire shelves. Ingenuity, again, solved the problem. Either copper-nickel-chromium plus clear enamels or zinc plate plus a clear dip and enamels were used. When tin again became available, the refrigerator people decided that the so-called substitute finishing procedures for shelves gave them less trouble than tin, and they have never returned to the tin.

There is considerable evidence to indicate that good plated coatings frequently fail because of porosity caused by electrolytic corrosion. Such failures are much less likely to develop with plated finishes which are insulated or "stopped-off" by the application of a clear-synthetic top coating. For this reason and many others, it appears that certain of the finishing practices so lightly touched upon in these remarks may well be adopted as the standard procedures rather than temporary practices.

(Continued on page 1047)

Abstracts of Convention Papers

(Continued from the September issue)

Chemical and Electrochemical Preparation of Zinc Base Diecastings for Electroplating, by Earl W. Arnold, Technical Service Engineer, L. H. Butcher Company, Los Angeles, Calif.

The preparation of zinc-base diecastings for plating consists of a precleaning operation, electrolytic cleaning, and an acid dip or etching operation.

The precleaning, the function of which is to remove contamination to a point where the electrolytic cleaner is effective, can be accomplished by organic-solvent cleaning, emulsion soak and spray, or alkaline soak. Organic solvents can be used in the vapor, spray, or immersion techniques or combinations thereof depending on the size and shape of the parts being cleaned and the nature of the soil. Emulsion cleaners are particularly useful for zinc-base diecastings in that they are effective, economical and do not attack the base metal even on long exposure. They lend themselves to use in a wide variety of ways, including power-washing machines. Precleaning with alkaline-soak cleaners should be limited to those cases where contamination is slight, but such cleaners have the advantages of low initial cost and maintenance.

Electrolytic cleaning may be either anodic, cathodic, or a combination of both, but with any of the techniques, care must be exercised to see that the surface of the diecasting remain virtually unchanged after going through the electrolytic-cleaning cycle. Although the composition of the cleaner is important, the success of the operation depends largely on such factors as temperature, concentration, cleaning time and current density. It is important to replace the cleaner frequently, or trouble from blistering or poor adhesion will be encountered.

Perfect adhesion of the deposit to zinc-base diecastings can be obtained only when all harmful films have been removed from the casting. The proper acid dip will eliminate surface oxides and chemical films from previous operations. Sulfuric, hydrochloric, hydrofluoric, or fluoboric acids may be employed satisfactorily when used under the proper conditions, and phosphoric and acetic acids have found some favor. The time of immersion is determined by the first signs of gas evolution. Rinsing after acid dipping should be thorough to prevent contamination of solutions in subsequent operations.

Electroplating Zinc Base Diecastings, by Chester G. Borlet, District Manager, United Chromium, Inc., Los Angeles, Calif.

One or more of a large number of metals may be deposited on a zinc-base diecasting, but all coatings must conform generally to specifications which cover general appearance, arrangement of multiple deposits, minimum thicknesses, resistance to salt-spray, ductility, and adhesion.

In all of the plating processes employed in meeting the specifications, careful control must be exercised over the variables which are responsible for the success of the plating operation. The variables can be divided into two categories, namely, internal variables, comprising composition, *p*H, temperature, current density, and impurities; and external variables, which include rinsing, agitation, current source, plating racks, and filtration.

Even though all components of a plating solution may be present in the correct relative amounts, excessive or insufficient total concentrations may result in poor deposits. Some baths are particularly sensitive to *p*H, and must be controlled very carefully. Current density and temperature are closely inter-related, and the selection of operating ranges for each of these variables requires a careful consideration of many factors, among which the geometry of the work and the current distribution on it are of utmost importance. Impurities are a fruitful source of plating difficulties, but techniques for their removal have been well established.

Sufficient rinsing facilities should be provided to remove all chemicals from the work before it goes to the next operation. The necessity of continually replenishing the solution around the cathodes requires agitation, which may be accomplished in a number of ways, either mechanically or pneumatically. Whatever the current source, it should be designed for the work in hand and operated under the conditions of load for which it was designed. Well-engineered racks properly coated with an insulator which will not contaminate the solution are required for the production of good deposits. Proper filtration helps immensely in the avoidance of rough deposits.

Evaluation of Quality of Electrodeposited Coatings, by Carl Durbin, Engineering Laboratories, Chrysler Corporation, Detroit, Mich.

Quality is defined as the ability of an electrodeposited coating to give satisfactory performance in service. Evaluation of quality may relate to the suitability of a coating for a given use, or it may be employed in production control.

The safest method for the evaluation of a coating for a given use is a life test in service, but at the same time certain properties of the deposit that can be determined in a short time should be measured for use

in production control. These laboratory measurements must be correlated with service tests.

The properties to be measured and the tests to be used to evaluate them depend largely upon the plated metal, the basis metal, and the intended use of the coating. Initial appearance, appearance after reasonable service, adhesion, thickness, internal stress, ductility, porosity, and hardness are some of the properties which can be determined directly or indirectly, and correlated with service life. The effects of thickness and adhesion are well known, but the relationships between internal stress and ductility and service life need a great deal of study. There is little doubt, however, that in at least some cases a combination of high stress and low ductility is detrimental. The controversial salt-spray test is of some assistance in the evaluation of coatings, but must be used with care.

Of the properties that are commonly measured, thickness and hardness can be determined with good objectivity. Adhesion, stress, ductility, and porosity are more difficult to evaluate, and are usually measured on special test specimens rather than on the work itself. In most cases more than one test method for a given property is available, and a careful selection must be made according to the requirements of the coating and the basis metal.

A knowledge of the finishing cycle greatly facilitates estimation of the quality of deposits, especially when variables in the plating cycle have been correlated with service.

Operating Control for Optimum Plating Characteristics, by R. O. Hull and J. B. Winters, R. O. Hull and Company, Inc., Rocky River, Ohio

By careful selection and use of simple but adequate control techniques, the operator of a small plating plant can avail himself of the many benefits which accrue from the scientific operation of plating solutions.

Mechanical and electrical variables should be controlled by a "foreman's check" at the beginning of each shift, and a list of items to be inspected is given.

Control of the plating solutions depends upon the results of chemical analysis and physical testing. Although there are many physical tests which may be employed, a plating test in a special cell will provide most of the information which the plater requires.

The concentration of primary constituents in the bath must be controlled by chemical analysis. Simple, reliable methods are given for all common plating solutions, and they will provide results which are sufficiently accurate for most operations.

The Hull cell, with which it is possible to make plating tests over a range of current densities in a single operation, is recommended for control of brighteners and impurities. The deposits prepared in the Hull cell, when interpreted in the light of experience and published information, yield information on bath variations before they begin to produce adverse effects in production plating. This is particularly valuable information, because the plater may use it to make corrections in the bath composition or operating conditions before he begins to produce the rejects that would otherwise be his only clue to the fact that something is wrong.

If the Hull-cell deposits indicate that trouble is imminent, experimental corrections can be made in the cell until corrective measures which give the proper deposit in the cell are found. This information, scaled-up in the proper proportion to tank size, may be used with confidence for the treatment of the bath without fear of ruining a large volume of solution.

A time chart showing when each test of the overall control routine is to be made is absolutely necessary if the utmost value is to be realized from control methods, for it is only in this way that trouble may be regularly detected before it causes damage.

Some Practical Considerations of Current Distribution, by Ralph A. Schaefer and Harry Pochapsky, Cleveland Graphite Bronze Company, Cleveland, Ohio

In electroplating operations the control of current distribution is very important in that it is only through such control that deposits of uniform thickness can be obtained on contour work and that minimum-thickness specifications can be met without depositing excessively thick metal on some parts of the work.

The variables which are of most importance in current-distribution problems are throwing power and the multitudinous physical, chemical and electrical variables which enter into the plating operation.

Throwing power has not been well defined mathematically, but qualitative values obtained by the method of Haring and Blum are useful as guides. It is found that all commercial baths may be classified into one of four groups, thereby indicating the extent of current distribution problems which are likely to arise.

The geometries of the individual anodes and cathodes, as well as their geometrical relationship to each other and the tank, are important physical variables. Several typical examples are discussed. Bipolar electrodes may be used to advantage in some cases to alter radically the normal current distribution. Agitation markedly affects current distribution by decreasing polarization, but normal temperature variations have little effect.

Amongst the chemical variables, increasing the bath concentration enhances throwing power, high *p*H is normally more desirable than low *p*H, and impurities and addition agents may either increase or decrease throwing power. These generalizations should be used only as guides, and it is necessary to investigate a particular bath very carefully to determine the exact effect of the chemical variables.

Current density, current efficiency and conductivity of the bath are the most important electrical variables. In general, metal distribution is more uniform at lower current densities. When current efficiency decreases with increasing current density, the throw-

ing power of the bath is improved. The conductivity of the bath normally has but little effect.

A New Degreasing Evaluation Test: The Atomizer Test, by H. B. Linford and E. B. Saubestre, Columbia University, New York City

A special specimen for the evaluation of tests for degreasing processes which exhibits uniform drainage has been designed and tested. It comprises a rectangular area of sheet metal with a tongue having an "S" bend at the top and a triangular extension at the bottom, and experience has shown that reproducible soiling and cleaning procedures can be carried out with it.

In the course of a study of tests which have been suggested for the evaluation of degreasing processes, it was found that a new procedure appeared to be far more sensitive than previous tests. The specimen to be evaluated is allowed to dry and is then sprayed for 30–45 sec with a dilute aqueous solution of a dye from an atomizer at a distance of 2 ft with a pressure of about 18 inch of mercury. After being dried with a heat lamp, the specimen will exhibit a dye pattern which reveals the areas that were not free of oil or grease. Permanent records can be easily made by tracing the dyed areas with a pantograph. It is suggested that the superiority of the atomizer test over the water-break test is due to its dependence upon an advancing contact angle instead of a receding contact angle.

The atomizer test was compared with the fluorescent-dye, spray-pattern, ferricyanide and copper-dip tests for the evaluation of the residual oil on partially cleaned specimens which had been soiled with lard oil or mineral oil. When considerable residual oil remains on the specimen, the atomizer and fluorescent-dye tests have about the same equivalent sensitivity and are 20 times more sensitive than the other tests. The atomizer test improves as the amount of residual oil is decreased and for small amounts may become 20 times as sensitive as the fluorescent-dye test and 600 times as good as the ferricyanide test. Radioactive-tracer techniques may be this sensitive, but they are both expensive and technically difficult, whereas the atomizer test is so simple and cheap that it may be used in even the smallest plating shops.

How the Plating Industry Will Benefit from Research on Metal Cleaning, by E. T. Candee, Director Research Development, The Lea Manufacturing Company, Waterbury, Conn.

Research activities may be classified as either applied or basic research, depending on whether the objective is the development of a product or a production process or the accumulation of thoroughly verified facts which may or may not have any immediate practical application. Inasmuch as basic research cannot be pursued effectively in most industrial laboratories and inasmuch as the facts and data obtained from basic research are necessary for progress in industry, the A. E. S. research program has been directed entirely toward basic research. The process of selecting a specific problem can be well illustrated by reference to Project 12, "Cleaning and Preparation of Metals for Electroplating".

The committee might have selected a problem on the effect of alkalinity in cleaners, the stability of wetting agents rate of saponification, residual films from cleaners, or any of numerous other problems of immediate practical interest. All of these, however, are difficult to divorce from proprietary and competitive formulations. They are also, in many cases, difficult to study in the laboratory away from the production line.

Attention was turned to the study of testing methods for evaluating the cleanliness of a metallic surface. The results of such an investigation will benefit the producers of basic chemicals, the manufacturers of proprietary cleaners and the users of cleaners. rather than a small group that might benefit from the solution of a specific practical production problem.

If the test for evaluation of cleanliness is to be of value to all who may want to use it, it must meet many requirements, and all pertinent facts concerning it must be investigated. The committee has listed ten cogent questions which must be answered in the course of the research, and the answers to these questions will determine the value of the atomizer test which is now under investigation or any other test which may be proposed. Any test which, by basic research, meets the criteria of usefulness will become a powerful tool for all workers in the field of metal finishing.

Highlights of the American Electroplaters' Society Research Program, by Donald Price, Oakite Products, Inc., New York City

Research in general may lead to new products, improved methods and processes, or basic scientific information. Inasmuch as the American Electroplaters' Society is not concerned, as a group, with the development of new products, its research program is concerned with devising better methods of testing and control or with the gathering of fundamental information which will be of assistance in solving a wide variety of practical problems.

Seven of the active projects of the A. E. S. research program may be divided into two groups, one having to do with the properties of electrodeposits and the other with the effect of various operating conditions on electrodeposited coatings. The eighth project is concerned with the disposal of plating-room wastes.

In the group of projects on the properties of deposits, Project No. 9 has accumulated a vast amount of data on the physical properties of nickel deposits prepared under a variety of conditions in 19 bath compositions. The work of Project No. 6 on the porosity of electrodeposits has progressed from studies of gas permeability to the development of a technique for following the rates of corrosion by analysis of the

(Continued on page 1051)

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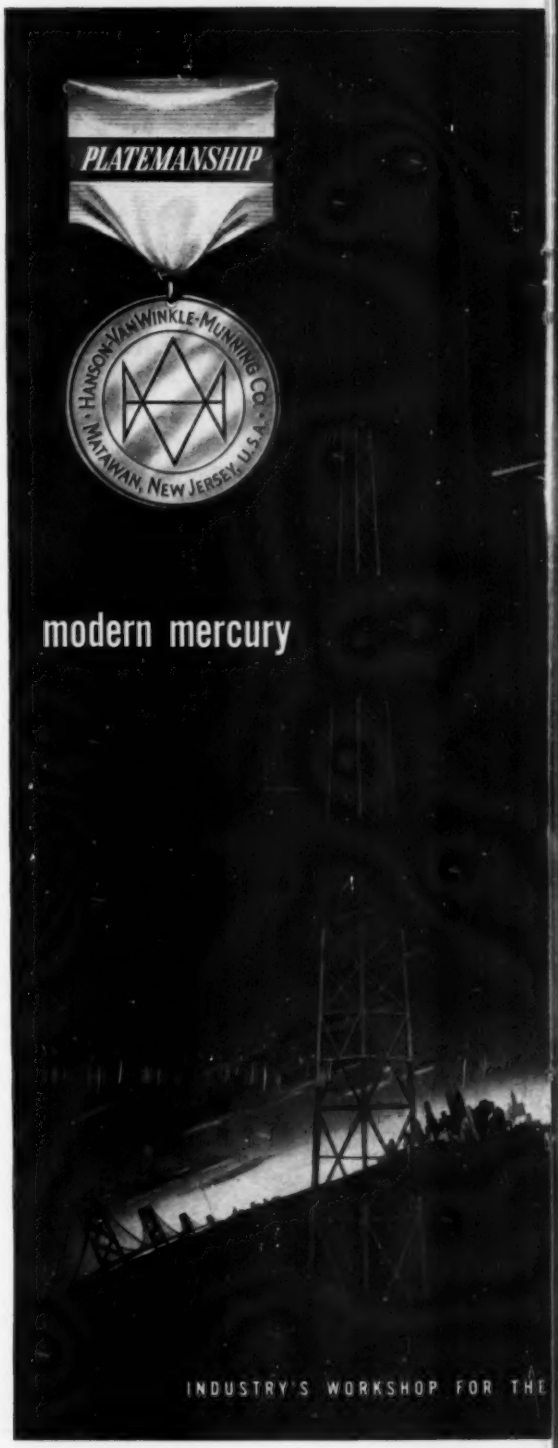

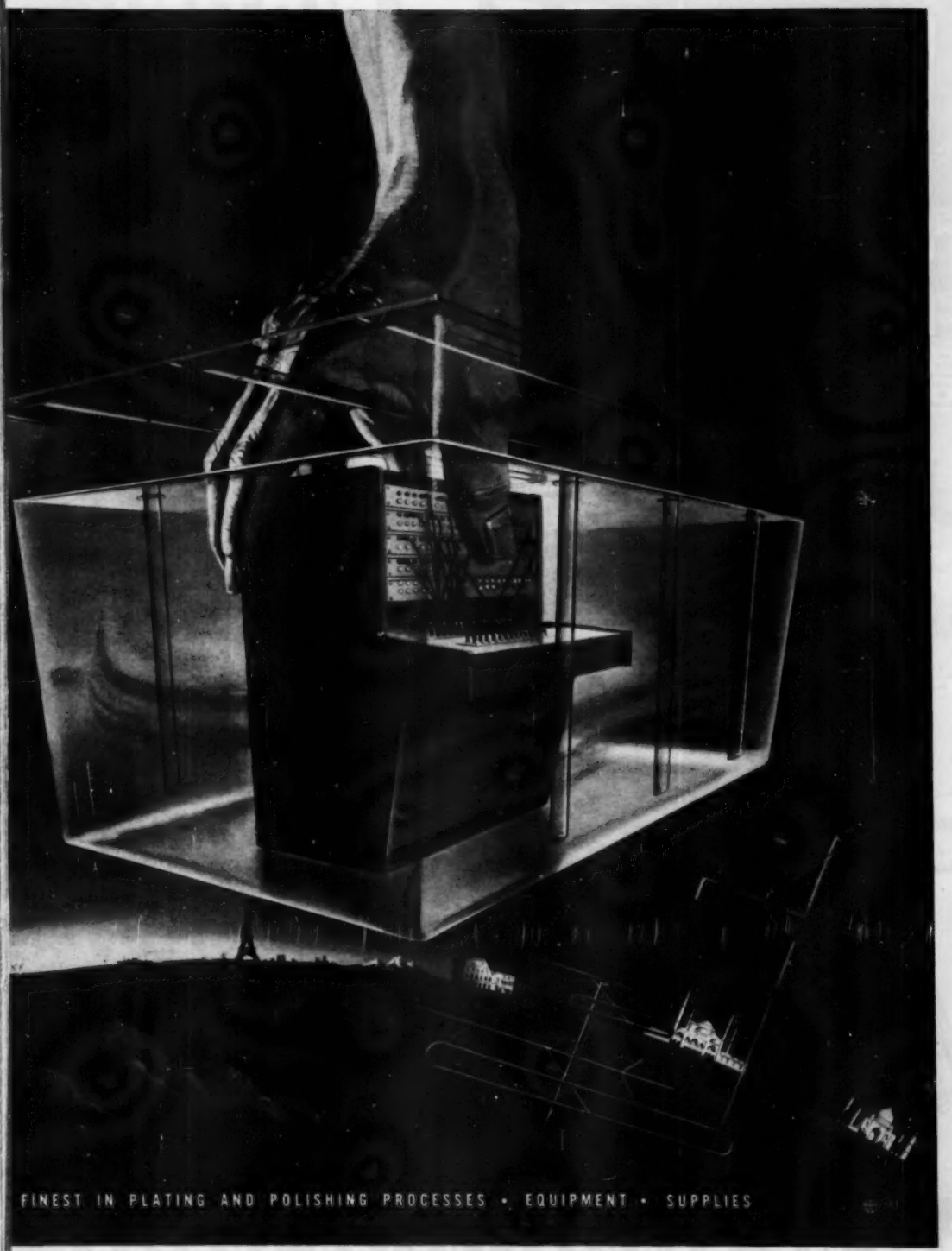
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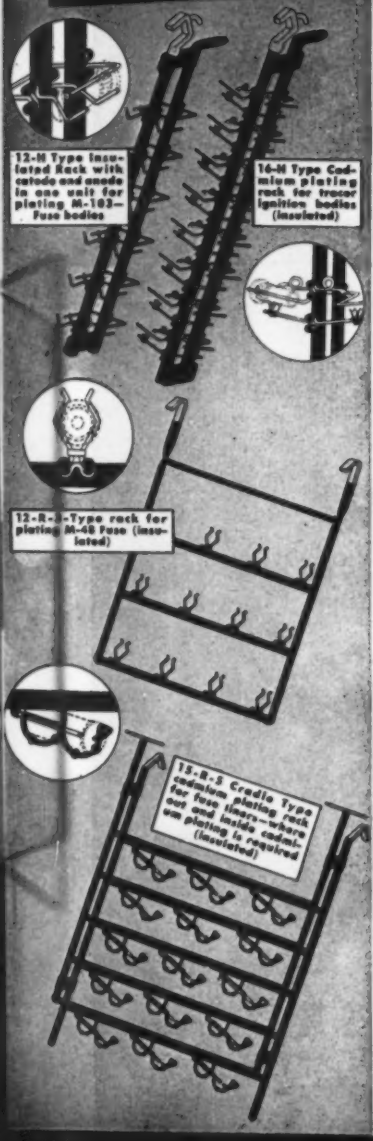
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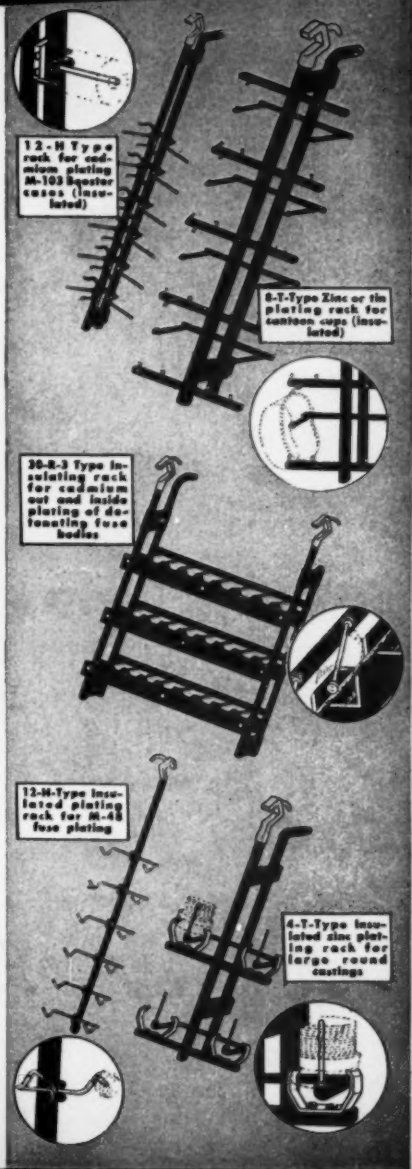
16-H Type Cadmium plating rack for tracer ignition bodies (insulated)
12-R-3 Type rack for plating M-48 Fuse (insulated)
15-R-3 Cradle Type cadmium plating rack for fuse bodies—where cad and inside cadmium plating is required (insulated)

FOR ANODIZING

8-H Type Anodizing Rack for airplane engine parts shown not insulated — can be furnished insulated
36-LV. Type Rack for anodizing airplane engine parts—can be furnished with or without insulation
42-R-7 Type anodizing rack for small airplane engine parts — furnished with or without insulation


12-H Type rack for cadmium plating M-103 Booster cases (insulated)
8-T-Type Zinc or tin plating rack for canteen cups (insulated)
30-R-3 Type insulating rack for cadmium out and inside plating of detonating fuse bodies
12-H-Type insulated plating rack for M-48 fuse plating
4-T-Type insulated zinc plating rack for large round castings

BELKE MANUFACTURING COMPANY
947 NORTH CICERO AVENUE · CHICAGO

RUST PREVENTIVES — A GENERAL SURVEY

ARNOLD W. ACKERMAN

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Introduction

The rust preventives described in this paper differ fundamentally from the metallic coatings and the so-called organic finishes in that they can be removed with readily procurable cheap solvents such as kerosene, naphtha or gasoline. Because of their ease of application, general economy, and superior rust protection, they have become increasingly important and popular for rust prevention.

These rust preventives form a relatively new and unique class of materials designed to protect metal from its worst scourge—rust. World War II was the accelerating influence in the development and practical application of these materials. Roughly, then, we may state that we are dealing with a field of endeavor only a decade or so in age, but which seems a good deal older by virtue of the rapid rate of development during the last war.

Classification of Preservatives

Basically all rust preventives fall into three main classifications, namely:

1. Fluid materials applied at room temperature from solvent solutions and deposited as relatively thin films upon solvent evaporation. The solvents may vary considerably from aliphatic to aromatic, or water may serve the purpose. Normally three grades are recognized: (a) Process rust preventives depositing a film 0.0001–0.0003 inch (2.5–7.5μ) thick; (b) an intermediate grade for protection during shipment and long-term indoor storage with films up to 0.001 inch (25μ); and (c) outdoor preservatives with films averaging 0.002–0.003 inch (50–75μ).
2. Solid materials of varying types and consistencies, applied hot
3. Lubricating oils of a wide range of viscosities (into which have been incorporated rust-inhibiting agents, etc.) for use in oil-lubricated bearings, internal-combustion engines, hydraulic units, turbines, gear boxes, slides, etc.

From a performance standpoint the solvent-type materials and the hot-application products are generally superior to the lube oils. Actually, most field problems can be easily and effectively handled by the polar solvent-type rust preventives. This, incidentally, is the type which has found wide favor in the metal finishing industry. It is a common occurrence in the evaluation of rust preventives to find that solvent films 0.0002–0.002 inch (5–50μ) thick give better protection than some hot-application coatings ten to one hundred times as thick. Within the three subdivisions of the thin-film solvent type, one encounters the entire range of rust preventive requirements . . . from temporary "in process" protection to coatings that will last indefinitely indoors and a year when exposed to the elements.

Brief mention should be made of two other methods of preservation which may be of interest to the metal finisher. One is the use of the strippable plastic coating, which is a special variation of the hot-application type and is useful in the shipment of relatively small critical parts or assemblies. The other is the use of what is termed "vapor phase inhibition" (VPI), wherein the parts are covered with a paper which has been impregnated with a suitable organic compound which sublimes and tends to passivate the enclosed metal. This technique is not foolproof unless it is used under ideal conditions, and best present practice seems to call for the use of a film former, such as those described previously, in addition to the VPI paper. This combination acts as a double form of insurance against rust.

Choice and Application of Preservatives

The same principles of surface cleanliness as are common in the application of metallic or organic coatings are applicable in the use of rust preventives. Inasmuch as the best preservative is practically worthless when applied over dirty surfaces, cleaning and preservation are fundamentally parts of the same problem. Application is best effected by dipping, next, by spraying or fogging, thirdly, by brushing, and lastly, by flow coating, roller or wipe. Whichever technique is used, all surfaces should be coated uniformly and continuously. Where hot-application material is used, special precautions should be taken to insure that the work will be allowed to come to the temperature of the bath in order to prevent chilling and excessive deposits of preservative.

Cleaning and Preparation

The standard cleaning techniques used industrially are applicable here, and include the following:

1. Mechanical methods such as sand or shot blasting
2. Alkali cleaning followed by thorough rinsing
3. Chlorinated solvents . . . with caution
4. Petroleum solvents, Stoddard or equal; kerosene should not be used since it may promote corrosion and staining
5. Emulsion cleaning preferably in spray washers

The choice and application of the various techniques will depend on several factors:

1. Composition of the part to be cleaned
2. Nature of the soil to be removed
3. Nature of the finish and degree of cleanliness necessary
4. Type and design of work
5. Cleaning equipment available
6. Industrial hazards and toxicity of the cleaner
7. Availability, cost, etc.

Selection of Rust Preventive

The choice of a preservative will depend on the following factors.

Type of exposure and degree of protection required

Will the parts be stored indoors or out, directly exposed to the elements or sheltered from the destructive actinic rays of the sun? Will the material be subject to high atmospheric humidity, possible water immersion (fresh or salt), acidic or alkaline corrosive atmospheres, high or low temperatures, wide temperature fluctuations, frequent handling, mechanical impact, or any combination of these conditions? Are the parts to be piled on top of each other? If parts are to be stored indoors, will they be subject to the diffuse rays of the sun? For what period of time will protection be desired against the above conditions?

In the numerous instances the time limits and severity of conditions for which preservation is required cannot be predetermined; the best possible system should be used in these circumstances.

If time limits are short and conditions are mild it is logical that work and expense should be saved by applying light, temporary rust preventives. Such conditions arise during process, short-time storage, preassembly, shipment of parts between the plants of a contractor, or shipment from a sub-contractor to a prime contractor.

In general, it is best practice to remove any process preservative before application of the final coating. Final coatings should therefore be applied on clean, substantially dry surfaces. Although there are some exceptions to this rule, no such application should be adopted without the approval of the supplier of the rust preventive.

Mention should be made of the properties of specially formulated solvent or lube oil preservatives which serve to displace water, soluble oils, emulsifiable oils, or alkaline rinse waters from metal surfaces and to deposit thereon the rust-preventive film. Basically, these function by having a greater attraction for the metal surface than the contaminants. In addition to possessing this property, the rust preventive must resist emulsification, sludging or breakdown in order to be adaptable for commercial use.

The problem of perspiration, its prevention and removal, has been puzzling many users of rust-preventive compounds. Fundamentally, three separate and distinct, yet closely related phenomena, are involved. One is the problem of removing freshly deposited, substantially wet perspiration. Another is the problem of preventing fingerprint deposition on top of a metal surface which has been coated with a suitable rust preventive. This coating may be freshly applied, or it may have been in place for some time. The last and most difficult involves the removal of dried perspiration salts, which consist primarily of sodium chloride, urea and lactic acid, from a clean metal surface with an organic solution that at the same time is both a fingerprint remover and temporary rust preventive. This is a very tricky problem, and there is only a handful of products marketed in the country that do this job. Fingerprint removers are not rust removers; once rust has started they can only prevent its extension.

The great bulk of the rust preventives that go into the metal-finishing industry are of the very-thin-film solvent types. In addition to the organic solvent type of product the industry also uses quantities of soluble oils and wax emulsions. In general, the use of aqueous solutions for rust prevention is not recommended. They have certain limited areas where their use is indicated, but wherever possible it is best to use the polar organic-solvent type of material. Wax emulsions in particular are troublesome, for it is difficult to apply continuous coatings of low permeability to moisture vapor. The residual-film thickness of the wax emulsions is necessarily low, and the films do not have a long protective life. Where wax films are desired they can now be obtained with organic-solvent-type rust preventives. The wax-solids content and hence the residual-film thickness can be varied to suit the application.

Composition of part to be preserved

Because many rust preventives are composed of highly surface-active materials, the forces which attract the preservative to the metal surface also tend in some cases to cause the preservative to react with the surface. This is particularly true of some compounds of sulfur, phosphorus or nitrogen, or when the preservative is highly acidic or alkaline. Copper, brass, bronze, lead or parts plated with cadmium, silver or zinc might be stained by the use of these materials and become unserviceable. Galvanic corrosion is a distinct possibility where protection of dissimilar metals is attempted with a conductive preservative. This difficulty sometimes arises with polar-type preservatives and should be guarded against. In practically all specification rust preventives, a negative effect on both ferrous and nonferrous metals is required. Because a given rust preventive may not afford the same protection to all metals, the coating should be selected to fit the metal or metals being protected.

If it is necessary to apply a preservative to assemblies consisting of metallic and nonmetallic parts, the reaction of the nonmetallic part with the preservative should be definitely known. For example, grease or oil-type coatings could be applied over special synthetic rubbers, but with natural rubber, solvents or oil types should not be used. Here the coatings should preferably be of

the hard, wax-like variety. Similarly, coatings coming in contact with cork, leather or paper should be of the "hard type" to prevent swelling or disintegration. Where mildew-proofing agents are used on the nonmetallic portion, the possible reaction of these materials with the preservative and with the metal must be considered. An interesting special problem is the attraction of certain fungi and bacteria for the protective coating itself.

Type of finish

If parts are rough forgings, stampings, etc., any preservative which fulfills the other necessary requirements can be used. Parts which have been black-oxidized, phosphated or plated require separate consideration. The author's organization has pioneered in the development of rust preventives for this field. Two standard coating thicknesses are used in these applications: a film of 0.0002 inch (5μ) where the application is a dip followed by draining, a coating of 0.0004–0.0006 inch (10–15μ) where parts are centrifuged to remove excess coating. In addition to the excellent protection obtained, these materials displace completely chromic acid, water or highly alkaline rinse waters from metal surfaces. Particularly important for the black-oxide users is their ability to resist alkali breakdown and sludging.

On highly finished surfaces held to close tolerances or on moving or sliding surfaces, the preservative should be light and very easily removable, or one which may be left in place without interfering with the future functioning of the assembly. Compounds depositing oil or light grease type films are best suited for this type of work inasmuch as they function both as lubricant and preservative.

Type and design of work

Fundamentally, parts should be cleaned and coated in as simple a unit state as possible. Complex constructions necessitate careful application of rust preventives in order that a uniform, continuous coating be obtained. Thick-film preservatives are not recommended for complex assemblies owing to the difficulty of providing a uniform coat. An approved thin-film compound, sprayed or dipped, will give better coverage and better protection.

Other properties expected of preservatives

In some cases, the nature of the part or assembly requires that the preservative function also as a lubricating oil or hydraulic fluid. In such instances, preservative properties are secondary to the lubricating or hydraulic functions. As usually happens with dual-purpose materials, one or both functions may suffer to some degree.

Nature of packing to be used over preservative

Before a particular type of final corrosion preventive is selected, it is necessary to know if and how the parts coated with the preservative are to be wrapped and packaged. Complete protection cannot be obtained unless both the preservative and the method of packaging are considered. For example, if parts are coated with a preservative which does not have good impact or abrasion resistance, the wrapping and packaging will have to be designed accordingly. If the packaged parts are to be exposed to rain, salt water, high temperatures, etc., it is necessary to correlate the methods of preservation and packaging in order to overcome the effects of exposure conditions.

The interaction upon each other of the various parts of the final packaged assembly—inner wrapper, corrosion-preventive compound and metal—is too often ignored. The compatibility of all components of the final assembly must be predetermined by suitable tests.

Methods of Testing

What methods are used in the rust-preventive field to evaluate these compounds? Salt spray, accelerated humidity, immersion tests in both fresh and sea water, exposure to the weather and weatherometer, exposure to diffuse sunlight, shed exposure, long-term indoor exposure, water displacement, fingerprint-removal tests, etc., are applicable. Any combination or all of these may be used by the progressive rust preventive manufacturer in his research and development program.

This is not the time or place to enter into a critical discussion of the test methods enumerated above. It is sufficient to say that in the author's laboratory less and less reliance is placed on the accelerated-test methods. Time and the conditions of exposure seem to be the critical factors in corrosion and rust-preventive evaluation. Because we have found no substitute for time we began some years back to evaluate both our old and new rust preventives on what we might call the long-term basis. In this connection, we investigated numerous complaints relayed both from government and industrial sources of what might be called staining caused by the rust preventives used. We later found that many so-called rust preventives were photochemically unstable and would break down under the influence of light, particularly sunlight through a closed window, to give the same characteristic yellow-orange or black stains that we saw in shop after shop. The staining effect can also be induced by increasing the pressure on the film in contact with metal surface. This happens in tote-boxes or in stacking. We therefore use, and place a good deal of reliance upon, what we call "operation sunshine" and "operation pile."

For better or worse, the metal-finishing industry is wedded to the salt-spray test. The salt-spray results in Table I are to be taken in a general rather than in a literal sense. They represent the average of many test runs on our own products over a period of years, and will give some idea of what can be expected.

Whereas the tabulated data deal with coatings over black-oxide or phosphate finishes, the results are also applicable to polished steel surfaces protected by rust preventives. Results for black oxide very nearly parallel those for polished steel, with a slight edge for the black oxide when the same preservative is used.

TABLE I. TYPICAL DATA ON SALT SPRAY RESISTANCE OF BLACK OXIDE AND PHOSPHATE FINISHES PROTECTED BY RUST PREVENTIVES

Salt-spray test: ASTM Designation B-117

Finish	Rust Preventive	Film Thickness inch	Salt Spray Resistance hr
Black oxide	Thin-film solvent	0.0002	24–48
Phosphate	Thin-film solvent	0.0002	100–250
Black oxide	Thin-film solvent	0.0005	48–72
Phosphate	Thin-film solvent	0.0005	150–250
Black oxide	Thin oil preservative (approx. 60 SUS at 100° F) (Spec. MIL-L-644)	0.00015	up to 24
Black oxide	SAE-30 preservative oil (Spec. MIL-L-3150)	0.00044	48–72

It is interesting to compare these results with the 1–3-hr average salt-spray life obtained with these same finishes *unoiled*. The salt-spray resistance of these finishes, therefore, depends predominantly on the type and quality of the final rust-preventive coating.

It is also interesting to compare these salt-spray values with those for plated or organic coatings of equivalent thicknesses.

Table II lists some salt-spray values for black-oxide finishes protected by soluble oil under varying conditions of concentration and temperature. It is seen that the protection afforded by soluble oil increases definitely with its concentration in water as well as with the temperature of application. It is also noteworthy that the 50 per cent emulsions give excellent salt-spray protection and compare favorably in this respect with the thin-film solvent-type preservative.

In some earlier work we have shown that freshly made emulsions gave somewhat better salt spray protection than aged emulsions.

We suggest, therefore, that soluble oils be applied at elevated temperatures (165–180° F; 74–82° C) and that they be kept reasonably fresh and clean.

Whereas soluble oils give reasonably good salt-spray results, they are in the main, as might be expected, very poor in the humidity cabinet. Specially formulated soluble oils, however, are available which give good humidity-cabinet life.

Tables III and IV give some typical humidity-resistance values on black-oxide and phosphate surfaces with the various coating types. The comparison between the coated and uncoated specimens is again marked.

TABLE II. EFFECT OF CONCENTRATION AND APPLICATION TEMPERATURE OF SOLUBLE OIL ON SALT SPRAY RESISTANCE OF BLACK OXIDE COATINGS

Salt-spray test: ASTM Designation B-117

Oil Conc. %	Application Temperature of	Time for Edge Rust hr	Time for Failure hr
10	Room	3	6
	180	12	24
25	Room	12–24	24–36
	180	24–36	36–48
50	Room	36*	48
	180	36*	48
Thin-film solvent, 0.0002 inch		36*	48

*No rust

TABLE III. HUMIDITY RESISTANCE OF BLACK OXIDE AND PHOSPHATE FINISHES PROTECTED BY RUST PREVENTIVES

Humidity test: Rotating-type humidity cabinet conforming to Specification AN-H-31 (JAN-H-392) and operated at 120° F and 100 per cent relative humidity

Coating application: Dipping

Finish	Rust Preventive	Failure days
Black oxide	None	1
Black oxide	10% *special* soluble oil at 180° F	13–18
Black oxide	Anderson Oil Standard Grade Thin-Film Rust Preventives of the solvent type	33*
Black oxide	Anderson Oil Light Lube-Oil Preservative (approx. 60 SUS at 100° F) (Spec. MIL-L-644)	33*
Phosphate	Dip in Anderson Oil Thin-Film Solvent-Type (Spec. AXS-1759, Grade II), film thickness 0.0006 inch	50*

*No rust

As in the salt-spray test, the performance of soluble oils in the humidity cabinet varies with the concentration and temperature of application.

Special Problems

There are some industrial problems that should be mentioned because their proper solution permits the safe and wise use of rust preventives.

Dermatitis

This subject is quite complicated and perhaps worthy of a separate paper. It is known that some rust-preventive additives are harmful to the skin of operators. Some may actually be irritants, others may defat the skin. Inadequately formulated solvent-type rust preventives are particularly harmful, and in this connection a number of practical safety measures can be taken. One involves the use of rubber gloves and the discarding of cotton or other fabric gloves, and another, the use of a protective, oil-insoluble hand cream. Last but not least, suitably formulated rust preventives which resist the defatting action of the solvent can be used. In connection with personnel safety, brief mention should be made of the problem of atomization of solvent- and oil-type preservatives. If spray methods are to be employed, adequate ventilation and facilities for removal of mist must be provided.

Fire Hazards

Most solvent type rust preventives supplied by reputable manufacturers will have flash points of 100° F (38° C) or higher. These so-called safety solvents are approved for industrial use by the Fire Underwriters. We have found them to be very satisfactory and can recall no case of fire caused by solvent inadequacies throughout our manufacturing history. This is not to say that these materials are not flammable. Common sense and adequate precautions should be the watchword. Normally, oil type and hot-application rust preventives present no fire problem.

Cost and Re-use of Rust Preventives

We are sometimes asked if a particular batch of contaminated rust preventive could not be cleaned up for further use. Sometimes this can be done with little effort and expense, but in the great majority of cases it is much better to discard the old preservative and start in with a fresh batch. Actually, this is by far the more economical procedure. Rust preventives are so low in cost, they average between 75¢ and $1.50 per gallon, and the coverage (in the thin-film solvent type) is so great, between 1500 and 3000 ft²/gal, as to render the burden of purification and filtration entirely unnecessary. When one considers that a couple of hundred square feet of surface can be covered for about ten cents, it can readily be seen that one has probably the most economical method of rust prevention from both an installation and maintenance point of view.

One further caution: do not mix rust preventives from different manufacturers! They may be incompatible, or the properties of the preservative may be otherwise affected.

TABLE IV. HUMIDITY RESISTANCE OF POLISHED STEEL PROTECTED BY SOLUBLE OIL

Type of Soluble Oil	Oil Conc. %	Application Temperature °F	Time for Failure days
Regular	25	165	1–2
Special	10	Room	4–6
		165	16
Special	25	Room	4–6
		165	23–25

Storage and handling

Rust preventives should be agitated before use and stored under cover, preferably above the freezing point of water. Do not return used rust preventives to the drum!

Summary

Rust preventives properly selected and applied can do an excellent job in practically every phase of the protection of metal. They are being used successfully on machinery, motors, farm equipment, spare parts, tools of all types, dies, molds, cutters, gages, sheet steel, tubing, bar stock, wire, and on every conceivable type of material for the Armed Services and civilian industry, for parts in process and for domestic and foreign shipment.

Abstracts (*Continued from page 1042*)

corrosion products. Project No. 13 will attempt to determine the practical significance of the work of Project No. 6 by establishing, if possible, a correlation between gas permeability of deposits and their behavior in accelerated and outdoor exposure tests.

Projects Nos. 2 and 5 both are concerned with impurities in plating solutions, the first with their determination and the second with their effects. Project No. 5 also deals with the effects of purification of the solution on the properties of the deposits. Project No. 2 has done much valuable work on the analysis of plating solutions for small amounts of harmful impurities. Project No. 11 has as its objective the development of simple methods to predict the optimum arrangement of work in a plating tank to secure uniform metal distribution on irregularly shaped objects. Project No. 12 is currently concerned with the study of a new test for the evaluation of cleaning processes.

Data for the scientific solution of waste disposal problems in the plating room have not been available in the past, and it is the objective of Project No. 10 to obtain such data. With this information, engineers will be able to solve specific problems systematically, rather than by trial and error.

CHICAGO...

Host City for A. E. S. 39th Annual Convention and 3rd Industrial Finishing Exposition June 16-20, 1952

In 1952, the greatest convention of the American Electroplaters' Society will be held along with the Third Industrial Finishing Exposition at the site of the first convention of the Society. Those who have attended previous conventions there will be looking forward eagerly to spending an enjoyable week in this metropolis at the foot of Lake Michigan.

For those who have not had the pleasure of visiting Chicago, we want to tell you in this issue of a few of the wonders to behold. To describe adequately the city that was once the home of Mrs. O'Leary's cow would require the grouping of at least a dozen adjectives, and would still fall short of painting a true picture.

History, often a dull subject, becomes fascinating and thrilling when associated with this great city. Everything about it is big, dynamic, polished, and yet, lusty. It is probably better known and loved by small-town people than any other large city. It is the only city in the world where it does not seem at all strange to find some of the largest buildings in the world surrounding a cowpath, left preserved amid the bustle of the busy Loop.

Chicago, the Host City, lives up to its name. Hotel accommodations are of the finest. Chicago has 1,385 hotels with a combined daily capacity of 225,000 guests. It has the tallest hotel in the world—the Morrison—and the largest in the world—our convention headquarters, the Stevens, with 3,300 rooms.

Transportation facilities excel those to be found anywhere else in the world. In spite of the fact that less than 100 years ago an ordinance was passed prohibiting any railroad entering or leaving the city, Chicago has today within its city limits more railroad track than all of the State of New York. Every 44 seconds a train arrives or departs, for a total of 1500 trains a day.

In aviation it is the same story. The heaviest volume of air passengers of any spot on the airline maps clears through the three major Chicago airports. For those who travel by car, roads are excellent and driving simple in Chicago. Bus users reach Chicago over 30 regional and national lines. So heavy has this traffic become that construction is in progress for the largest terminal in the country, in Chicago's Loop. You can see that we have facts to substantiate our claim that all roads lead to Chicago in 1952. About the only way you can miss Chicago is to stay at home.

For those who wish to look at the sights, there is enough to keep you busy for a month. You can look in the Park across the street from the Stevens Hotel and see Buckingham Fountain, the largest and most beautiful in the world. Adler Planetarium, the first planetarium in the United States, is located near by on the Lake Front. Two of the finest museums of their types, Field Museum of Natural History and the Museum of Science and Industry, are easily accessible. Of particular interest is the Museum of Science and Industry where exhibits move, operated by the spectator. Press a button and a cutaway model of a jet engine commences operation. Here you can see yourself on television, hear your own voice on the telephone, or even go through an operating coal mine. These and other features will hold you fascinated for hours.

Members of the Exposition Committee shown poring over exhibit layouts are, left to right, Herberth E. Head, Briggs Mfg. Co., Detroit, Mich.; Lew Glassner, Glassner & Associates, Chicago, Ill., Exposition Director and Promotion Manager; Clyde Kelly, B. Mercil & Sons Plating Co., Chicago, Ill., and Walter C. Dietrich, Advertising Manager of PLATING

In Chicago is located the largest commercial building in the world—the Merchandise Mart. The Empire State Building in New York would have to be 67 floors taller, or 169 stories high, to duplicate the area of the Mart. You can spend days, and a fortune if you like, in the downtown stores. The internationally famous Marshall Field & Company contains 73 acres of floor space, and in addition to voluminous mail orders they handle as many as 35,000 telephone calls a day.

The Amphitheatre, site of the Third Industrial Finishing Exposition, is within the grounds of the Chicago Stock Yards, where is also located the famous Stockyard Inn. There, in its Sirloin Room, you can choose and brand your own steak before it goes to the kitchen.

In Chicago there is entertainment of every description going on continuously: opera, concerts, the legitimate theatre, and for those who enjoy a more basic form of entertainment, Riverview Park, the largest amusement park in the United States. Chicago is the home of the first night club, and it also admits to being the home of the cover charge, which, at the time it was first applied in the City of Chicago, amounted to the grand sum of ten cents!

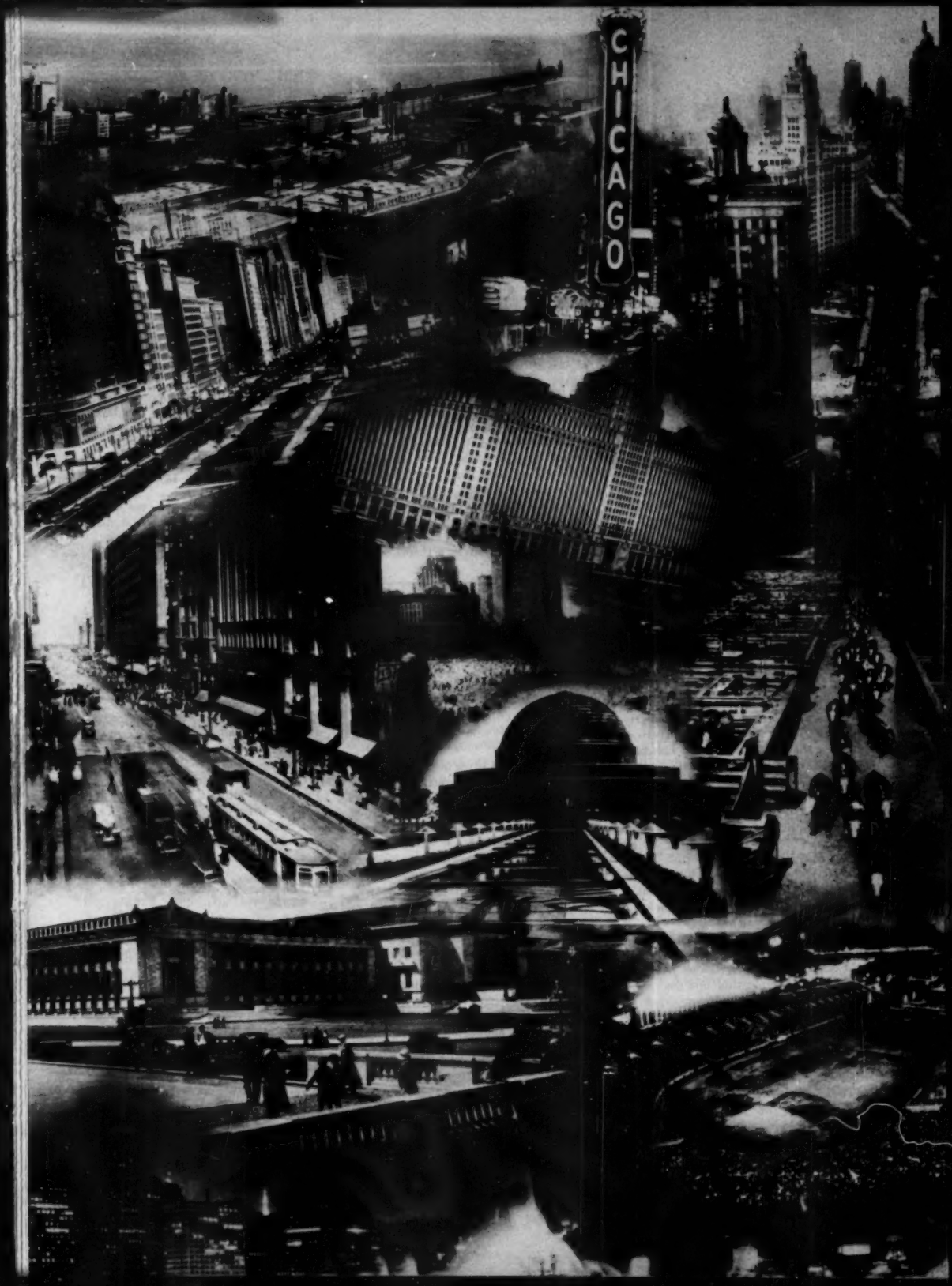
Those interested in industrial wonders will find that almost everything is manufactured in Chicago. Here you will find over 6,000 different industries, ranging from farm implements to candy.

A generation ago the late civic leader, Burnham, father of the city's widely imitated Chicago Plan, carved in memory the injunction to his fellow townsmen: "Make no little plans." This might well be the motto for the 1952 convention. To those who attend the Chicago convention and to all of those who have not really seen the city, a wonder is awaiting.

The convention is scheduled to run from Monday, June 16, to Friday, June 20, 1952, at the Stevens Hotel on Chicago's famous Michigan Boulevard. Concurrently, at the International Amphitheatre, 43rd and Halsted Streets, the Third Industrial Finishing Exposition will hold forth along with the educational sessions at the Stockyard Inn. The Amphitheatre parking facilities accommodate 4,000 cars and buses will shuttle between the Stevens Hotel and the Amphitheatre, free to all registrants.

The Exposition will provide about 90,000 square feet of space for exhibitors. Along with manufacturers of plating equipment and supplies, plating instruments, and paint and allied equipment, related companies in such fields as abrasives, masking tapes, chemicals, polishing and buffing, safety devices, materials-handling, etc., are invited to exhibit. Inquiries should be directed to the Industrial Finishing Exposition, Suite 580-584, 35 E. Wacker Drive, Chicago 1, Ill.

Kaufman & Fabry Photo ▶


CHICAGO

We yearn to learn — continue A. E. S. wives in 1951

FRANCIS M. (MRS. AUGUST) HOFFMAN, *Cleveland, Ohio*

We still remember the Ladies Sessions at the Boston A. E. S. Convention very well, don't we? And we still declare them to be the best in 1950.

The Ladies Sessions in Buffalo will also be long remembered, and we now declare this Convention to be the best one in 1951.

The "Get-Acquainted-and-Renew-Acquaintance" Luncheon on Monday Noon started the ladies activities with much fun and chatter. The Buffalo ladies had been fearful that they might have to "eat straw hats", but the attendance was the largest ever, so they won the bet and were spared the indignity and tummy ache.

The "Night of Food, Frolic and Fun" on Monday night was very successful. Thanks to The International Fellowship Club! The food was delicious and plentiful, the orchestra was extra-special, and a jolly time was had both by the ladies and their husbands.

On Tuesday, many ladies renewed memories of their honeymoon. Leaving our husbands behind on this second trip, we journeyed to Niagara Falls. There we enjoyed the Aunt Ella Society Luncheon at the General Brock Hotel, another lovely event sponsored by the Oakite Products, Inc. We were sorry that Dave Clarin, our regular host, was not able to be with us, but we are sure that he would have been delighted and proud of his substitute. We all agreed that Henry Johnson did a fine job. Much credit goes to him for finding Cinderella who walked away wearing the fairy glass slippers and clinching a 5-dollar bill.

A delightful event took place on Wednesday afternoon at the Automobile Club in Clarence, N. Y. Delicious food and cold drinks were plentiful, and gave us so much "pep" that we could participate in ball-games, miniature golf and other activities with enthusiasm and vim. We were not aware of the fact that Buffalo could raise such large numbers of fried chickens.

The Technical Session for the Ladies took place at the Thursday Luncheon. This year it was sponsored by The Udylite Corporation. All the ladies declared that it was much easier to learn the "Platers Secrets" during an excellent luncheon. Dr. Saltonstall did a wonderful job in explaining "why" and "how" we electroplate. Continuing where our education on electroplating left off last year, he gave us an enlightening talk on the extreme care which must be taken in preparing articles for plating and why it is important that articles be plated. The ladies talked freely and intelligently about anodes in the form of bars or balls connected to the positive side of the current and about cathodes connected to the negative side of the current. We learned too what makes it difficult to apply a uniform thickness of plate on a complicated article. I'm sure that the ladies will treasure their new vocabulary and value their information, which make it possible for us to discuss this particular phase of plating with our husbands. Following the inspirational talk, the ladies were privileged to participate in a discussion led by Dr. Saltonstall. Many vital questions were answered most graciously and wisely, such as how to plate silver articles, how to

combine gold and silver plate on the same article, how to clean silver, and ways of plating articles to give them the appearance of another metal. One lady wanted the Professor to answer "one little question". The Professor was stumped. The lady wanted to know where we can buy nickel anodes "right this afternoon." We had an interesting time and took away many suggestions that we can apply in every-day good housekeeping.

The Annual Banquet on Thursday night was truly a lovely event. The roast beef was delicious, and the social activities that followed made the evening a very enjoyable one.

Mrs. Nigro, Chairman, and her Ladies Committee did an outstanding job. They made the ladies feel *wanted* at the Convention, and they actually prepared that "prize-winning recipe for the busiest and gayest Convention" of which they had written in the program. Their graciousness and hospitality were woven into the well-organized and profitable program which they executed so efficiently.

As the ladies gathered in groups and discussed the Convention as a whole, they all felt that each year they have a better time. Each year the Committee finds something new to offer and enlarges upon the best of the old ideas.

The regular technical and business side of the Convention is left to the men. Enough technical knowledge, however, is given to the ladies to make them feel that they are a part of the Convention. The many social activities keep them active and happy. They become acquainted with people from all over the country and treasure these friendships. They become aware of the problems encountered by their husbands in their shops and gain an understanding that leads the way out of many difficulties.

Thank you, Buffalo ladies, for a lovely time. We appreciate your sincere and successful efforts.

We are looking forward to the Chicago A. E. S. Convention. We know it will be the best in 1952.

BRANCH SPEAKERS LIST

A Correction

An error occurred in the listing for the Society's Headquarters Staff. It should be as follows:

AMERICAN ELECTROPLATERS' SOCIETY

HEADQUARTERS STAFF (c)
Box 168, Jenkintown, Pa.

K. G. SODERBERG, Editor of PLATING, Subjects 1, 2 and 3

H. J. READ, Assistant Editor, A. E. S. *Proceedings*, Subjects 4, 5 and 6

W. C. DIETRICH, Sales Manager, PLATING, Subjects 2 and 3

A. K. GRAHAM, Executive Secretary, A. E. S., Subjects 7, 8 and 9

Subjects:

1. *Fundamentals of Zinc and Cadmium Plating*
2. *Things You Should Know About* PLATING *Magazine*
3. *Operation of the American Electroplaters' Society*
4. *Corrosion Phenomena in Electrodeposits*
5. *The Technique and Significance of Microhardness Measurements on Electrodeposits*
6. *The Mechanical Properties of Electrodeposits as Determined by the Bulge Test*
7. *Things You Should Know About the American Electroplaters' Society*
8. *Substitute Finishes for Critical Plating Materials*
9. *Disposal of Plating Room Waste from an Electroplater's Viewpoint*

project no. 6

project director:
N. THON*

associates:
DENIS G. KELEMEN†
LING YANG*

location:
FRICK CHEMICAL LABORATORY
PRINCETON UNIVERSITY,
PRINCETON, N. J.

Acknowledgment is due the Research Committee, Dr. A. W. Wesley, The International Nickel Company, Chairman; the Research Directing Committee, Mr. Guy M. Cole, Ternstedt Division, General Motors Corporation, and Dr. Donald Price, Oakite Products, Inc., Chairman and Vice-Chairman, respectively; and the Project Committee, Dr. Louis Weisberg, Consultant, New York City, Chairman; Dr. B. Egeberg, International Silver Company; and Mr. Clifford Struyk, General Chemical Division, Allied Chemical & Dye Corporation, for their contributions to this project.

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Porosity of Electrodeposited Metals

X. HYDROGEN CONTENT OF ELECTRODEPOSITED METALS

Introduction

In the search for factors which may be related to the previously observed differences in the gas permeabilities, both initial and developed on exposure, of electrodeposited foils, it was deemed worthwhile to investigate the amounts of hydrogen occluded in different metals, electrodeposited under different conditions.

That metals produced by electrodeposition in aqueous solution may occlude significant amounts of hydrogen has been known for a long time. It has also been known that different metals present sharp differences with respect to their tendency and capacity to take up and to retain hydrogen. Electrolytic copper produced in acid sulfate solution occludes practically no hydrogen. At the other extreme, palladium is known to retain very large amounts. Metals of the iron group occupy an intermediate position.

Experimental

The determinations were made partly on electrodeposited foils stripped from a mechanically polished stainless-steel base, partly on deposits left to adhere on copper, after blank experiments have shown the latter base metal to be free from detectable amounts of hydrogen. In both cases, the amounts of the deposited metal were ascertained by weighing. A sample of known weight was placed in a quartz tube of 1.5-cm diameter, and the tube was evacuated to about 10^{-4}-mm Hg. The temperature of the electric furnace holding the tube was then raised to 65° C (149° F) and kept there for about one hour to drive off the moisture. The pump was disconnected, and the tube made to communicate, through a liquid-air-cooled trap, with a mercury manometer. The temperature was raised to 800° C (1470° F) and maintained at that temperature until complete cessation of the increase of the pressure, which was usually accomplished in an hour or so. The major part of the gas was evolved below 600° C (1110° F), most of it from 500° C (930° F) upwards; the higher temperature of 800° C (1470° F) was used to ensure completeness of the extraction. The system was then evacuated and the manometer read again. The total amount of gas evolved from the specimen was calculated from the difference between the two manometer readings and from the known volume and temperature of the system.

That the extracted gas was all hydrogen was confirmed by its combustion. Instead of the manometer, the quartz tube was connected with a gas buret containing a known amount of pure oxygen and carrying two sealed-in tungsten-wire electrodes. The gas given up on heating at 800° C was pressed into the buret, and the gas-oxygen mixture was exploded by means of a spark. The amount of hydrogen determined from the volume contraction after combustion checked very exactly with the amount determined manometrically. Inasmuch as at the relatively low temperature of 800° C no combustible gas other than hydrogen was given up by the metal, the qualitative and quantitative identification is satisfactory. It is conceivable, as will particularly be

TABLE I. EFFECT OF BATH COMPOSITION

Bath	H:Ni
W	1:300
C	1:360
S	1:300
WB1	1:620
WB2	1:900
WB3	1:900
WB4	1:450

shown later on, that some hydrogen was lost in the operation, and that our determinations are below the original true hydrogen contents of the specimens. But it is unthinkable that they should be in excess of it. Consequently, our figures represent the lower limit of the actual hydrogen contents.

As will be described more fully in the following, the hydrogen taken up by an electrodeposit in the process of its electrolytic formation is composed of two distinct portions. One part, held only loosely, is given up within a matter of minutes, and without heating. The balance is evidently held much more tightly, and is given up only upon heating. The determinations reported here refer to that *retained* hydrogen.

Expression of the Results

All of our results have been recalculated to and are expressed in terms of the atom ratio H:Ni $= 1:n$. A larger n means, of course, less retained hydrogen, and vice versa.

Nickel Deposits

The data in Table I refer to foils 8 microns (0.0003 inch) thick, produced on and lifted from stainless steel, at 60° C (140° F), a current density of 2 amp/dm² (19 asf), and *p*H 2.5, from relatively fresh baths having undergone 10 hours' electrolysis at 0.2 amp/dm² (1.9 asf), or a total of 1 amp-hr/l, and having the following composition, in g/l:

W (Watts): $NiSO_4.6H_2O$, 330; $NiCl_2.6H_2O$, 45; H_3BO_3, 30

C (Chloride): $NiCl_2.6H_2O$, 300; H_3BO_3, 30

S (Sulfate): $NiSO_4.6H_2O$, 300; H_3BO_3, 30

WB1: Watts + 1 per cent (by weight) of Ni benzene meta-disulfonate

WB2: Watts + 0.1 per cent (by weight) of Na naphthalene-1, 5-disulfonate

WB3: Watts + 0.1 per cent (by weight) of Na 1-naphthylamine-4, 8-disulfonate

WB4: Watts + 0.1 per cent (by weight) of Na 1-naphthylamice-3, 6, 8-trisulfonate

The figures for WB3 and WB4 have been corrected in the following manner: One ninth of the gas extracted proved, by explosion and by absorption with magnesium, to be nitrogen. This gives the amount of the organic substance taken up by the deposit, and, from the known N:H atom-ratio of the given compound (1:7 in B3, 1:6 in B4) it gives the amount of hydrogen taken up, not from the hydrogen ions of the bath, but along with the organic substance adsorbed in the deposit. The observed amount of total gas, in both B3 and B4, corresponded to (H + N): Ni = 1:100 = 9:900. Deduction of the N_2 gas (1/900) and of the "organic" H (7/900 and 6/900, respectively) leaves, for the hydrogen taken up from the water, H:Ni = 1:900 and 1:450, respectively.

The definitely lower hydrogen content of chloride nickel as compared with Watts and with sulfate nickel is well beyond experimental uncertainties and is reproducible under identical conditions. It parallels the previously stated slower development of gas-permeability porosity in chloride nickel as compared with sulfate and Watts nickel of equal thickness.

The four organic compounds listed above, all of which produce deposits of high luster, evidently reduce the amount of hydrogen taken up through discharge of the hydrogen ions of the bath. This is clearly due to adsorptive competition between hydrogen atoms and molecules of the organic compound. It had been shown previously* that these four compounds enhance both the initial permeability and the corrosion-developed porosity of electrodeposited nickel foils, and it appears plausible to correlate that effect with adsorptive occlusion of these compounds in the deposit. In the absence of such adsorbable extraneous substances, hydrogen, obligatorily taken up from the aqueous solution, plays the role of "foreign body". High amounts of it are known also to produce luster and stresses, i. e., effects similar to those produced by a variety of adsorbable organic addition agents.

Table II shows the effects of lower temperature and of *p*H in 8-micron thick nickel foils (deposited on stainless steel at a current density of 2 amp/dm²). The lower temperature favors greater occlusion of hydrogen, especially in chloride nickel; a slight lowering of the amount occluded with increasing *p*H is found at 5.0.

Subsequently it was observed that deposits produced from baths which have been operated for a longer time contained smaller amounts of hydrogen. Thus, in an 8-micron Watts-nickel foil, the H:Ni ratio of 1:300 found in a bath preliminarily operated for 10 hours at 0.2 amp/dm² fell to 1:1000 in a bath having had 75 hours' service at the same current density. It remained at the same level in a bath subjected to 100 hours' purification by electrolysis. The following determinations refer to baths preliminarily broken-in for 75 hours (equivalent to 7.5 amp-hr/l).

The parallelism between hydrogen content and tendency to porosity repeated itself in deposits produced on different base metals. Table III refers to 8-microns thick Watts-nickel foil, produced at 60° C, 2 amp/dm², and *p*H 2.5 from a bath preliminarily purified for 75 hours at 0.2 amp/dm². Nickel deposits on crystalline copper contain roughly one-third of the amount of hydrogen found in nickel produced on polished stainless steel. This factor of 3 parallels the previously found ratio of porosities.

Our attention was called† to the fact that our figures for the hydrogen contents were substantially and systematically higher than the results of analyses carried out at the National Bureau of Standards. The root of the discrepancy became apparent to us upon exchange of samples with the Bureau of Standards. Their samples were considerably thicker than ours, of the order of millimeters. Our supposition that the hydrogen content of electrolytic nickel might decrease with increasing thickness of the deposit was fully confirmed, as is shown in Table IV which refers to Watts nickel produced under the same conditions as in Table III. Further increase of the thickness produces a further slight, but not appre-

TABLE —II. EFFECT OF THE TEMPERATURE AND OF *p*H OF PLATING SOLUTION

	Nickel Deposit					
	S		W		C	
	Temperature, ° C					
	25	60	25	60	25	60
*p*H	H: Ni					
1.0	1:220	1:300	1:200	1:300	1:140	1:360
2.5	1:250	1:300	1:240	1:300	1:150	1:360
5.0	1:265	1:330	1:250	1:350	1:150	1:400

*Plating 37, 752 (1950).

†Private communication of Dr. Abner Brenner.

ciable lowering of the mean hydrogen content. However, if integrated over a total thickness of about 2 millimeters, this decrease of the hydrogen content with increasing thickness may well result in a considerably lower mean hydrogen content in thick deposits.

It is thus confirmed that hydrogen is occluded more abundantly in the first layers of the nickel deposit, its amount decreasing with increasing distance from the base surface. The gradient of the hydrogen content across the thickness of the deposit accounts for the well-known stress and curling-up phenomena. If, as we take it, a lower hydrogen content (in the absence of other adsorbable extraneous matter) parallels a lesser tendency to porosity, it becomes evident that a thicker nickel deposit will be more corrosion resistant, not only by the mere effect of its greater thickness, but also thanks to the lower hydrogen content at a greater distance from the base surface.

Qualitatively, this was confirmed by exposure experiments wherein only one side of the foil was exposed to the corrosive atmosphere (vapor of HCl). In all cases, the *initial* rate of corrosion, as measured by the rate of increase of the gas permeability, was somewhat higher in foils exposed with their inward side (i. e., the side nearest to the base metal) facing the corrodent, than in foils with the outward face exposed. However, this difference is noticeable only at the initial stage, and vanishes as soon as the gas permeability of the foil becomes significant, i. e., when the corrosive atmosphere has penetrated to the other side and has begun to attack both faces. The hydrogen-richer bottom side of the deposited foil is more vulnerable to corrosive attack.

Deposits of Copper, Chromium and Iron

As already stated, no hydrogen was detected in copper deposited from acid sulfate solution. Cyanide copper does retain very small amounts of hydrogen, of the order of H:Cu = 1:10000. Evidently, occlusion of hydrogen is not related to either low current efficiency or high cathodic polarization, but is a specific property of the metal.

Chromium, electrodeposited in a thin layer on (hydrogen-free) copper sheet, showed a very high hydrogen content, H:Cr = 1:20.

Iron, electrodeposited from warm chloride solution ($FeCl_2 \cdot 4H_2O$, 375 g/l (50 oz/gal); $CaCl_2$, 190 g/l (25 oz/gal); temperature, 95° C (203° F); current density, 5 amp/dm² (46 asf) on copper, showed, in thin layers of the order of 10 microns (0.0004 inch), high hydrogen contents, H:Fe = 1:130. A 100-micron (0.004 inch) thick foil showed a substantially lower hydrogen content, H:Fe = 1:900.

Codeposited and Electrolytically Incorporated Hydrogen

By "codeposited hydrogen" (in the following to be designated by co-H) we mean the hydrogen taken up, and retained, by the deposit in the course of its deposition. The preceding paragraphs refer to such co-H.

"Electrolytically incorporated hydrogen" (to be designated by in-H) is the hydrogen taken up by the ready-made metal foil through subsequent cathodic charging with hydrogen in an appropriate electrolyte. The electrolyte adopted for that purpose was 0.1-*N* H_2SO_4, poisoned with 0.001-*M* sodium arsenite, and the operating conditions were room temperature, 2 amp/dm² (19 asf), 12 hours. The purpose of the poison is to suppress the recombination of H atoms to H_2 molecules, normally catalyzed by the metal surface unless poisoned, and thus to facilitate penetration of (atomic) hydrogen into the metal.

It developed that "co-H" and "in-H" behave in markedly different ways, particularly from the point of view of tenacity of retention.

A first, and large, portion of the hydrogen taken up by the deposit in the course of its deposition is held very loosely, and escapes without heating within a few minutes. It is known that when a fresh electrodeposit is immersed in water gas bubbles are seen to escape from it. This loosely held gas is no doubt hydrogen dissolved in the metal to supersaturation, but in equilibrium with the atomic hydrogen covering the surface of the metal as long as electrolysis is continued. Upon interruption, the H-atom layer at the surface disappears, and the hydrogen interstitially dissolved in the metal far in excess of its normal solubility is released practically instantaneously.

The retained co-H is characterized by a high degree of tenacity. One of our 8-micron (0.0003-inch) nickel specimens showed a practically unchanged hydrogen content after a year and a half of standing at room temperature. A thick electrolytic nickel sheet (500 microns; 0.020 inch) lost 25 per cent of its co-H in two hours at 200° C (392° F), but the rest was released only above 550° C (1020° F). A 50-micron (0.002-inch) nickel foil gave up no gas at all in two hours at 275° C (527° F). Thick electrolytic iron foils (100 microns; 0.004 inch) showed, at room temperature, only a very slow although definite decrease of their co-H content in months.

Fresh iron foils of that thickness lost no co-H at all when heated half an hour at 550° C (1020° F) or one hour at 350° C (660° F); outgassing began above 550° C (1020° F) and was complete only at 700° C (1290° F).

On closer study of the conditions of outgassing co-H in nickel and in iron, we learned that the amounts released on heating to not over 550–600° C (1020–1110° F) may, occasionally, be somewhat higher than the amounts collected by our standard method of heating to at least 800° C (1470° F). The slight deficit of hydrogen gas collected under the latter conditions is evidently due to some oxidation of hydrogen by oxides contained in the deposit. The question of the most suitable heating conditions is a matter of striking a balance between the requirements of driving out all of the co-H and of avoiding losses through oxidation to water. Inasmuch at our procedure definitely does meet the first requirement, our figures can at most be somewhat below the actual hydrogen contents, but very certainly not in excess.

Attempts of driving out the co-H by mounting the foils as anodes in a high-voltage (1 kv/cm) discharge tube, following the procedure of Hulubei[9], were negative, unless the foils became visibly hot, in which case the outgassing went in a matter of seconds. However, there was no outgassing in assuredly cold discharge.

In electrolytic anodic treatment in 0.1-*N* NaOH at room temperature, 2 amp/dm², 12 hours, a 50-micron (0.002-inch) Ni foil lost less than 10 per cent of its co-H, but did take up oxygen (0.5 volume of gas per volume of metal) which was released by heating to 500° C (930° F), *prior* to the release of the hydrogen.

By prolonged electrolytic charging in poisoned sulfuric acid, it is possible to incorporate more hydrogen into electrolytic foils of nickel or of iron. Thus, the H:Ni ratio of a 50-micron (0.002-inch) Watts-nickel foil changed, as a result of 12 hours charging, from 1:1000 to 1:250, and for a 100-micron electrolytic iron foil, the H:Fe ratio changed from 1:900 to 1:750. However, and in contrast to the

[9]Compt. rend 199, 199 (1934).

TABLE III. EFFECT OF BASE METAL

Base Metal	H:Ni
Stainless steel, mechanically polished	1:1000
Copper, mechanically polished	1:600
Copper, electrolytic from acid bath, crystalline	1:3000

TABLE IV. EFFECT OF THICKNESS OF DEPOSIT

Thickness microns	H:Ni
8	1:1000
60	1:3300
100	1:3600

high tenacity of co-H, this incorporated in-H is held more loosely, even though considerably more tightly than the initially and instantaneously escaping supersaturation hydrogen. As a rule, the in-H could be driven off completely on heating to not over 150-170° C (300-340° F). On standing at room temperature, samples were found to have lost all of their in-H after two months, possibly earlier. Electrolytic nickel can also be recharged cathodically with hydrogen after it has been completely outgassed and annealed at 900° C (1650° F); thus, the previously mentioned 50-micron foil with originally H:Ni = 1:1000, outgassed and annealed, and recharged, gave H:Ni = 1:250, and *this* hydrogen was completely released at 150° C (300° F). Practically none of it was lost in anodic treatment in NaOH, and the oxygen taken up in this process was released, on heating, only *after* the release of the in-H. Characteristically, electrolytic iron, outgassed and annealed at 900° C (1650° F), did not seem to take up any significant amount of in-H (at most, in one case, H:Fe = 1:2100, as against 1:900 for co-H, and 1:750 for co-H + in-H, without outgassing). It is possible that, in annealed iron, in-H is held *so* loosely that it escapes very rapidly even at room temperature.

Different Forms of Occlusion of Hydrogen

On the basis of the foregoing, hydrogen can exist in a metal in at least three forms: the highly labile supersaturated-solution form, the co-H form, and the in-H form. Considerations based on facts and theories of strain hardening of metals, and on changes of sharpness of X-ray diffraction lines, to be reported in a later publication, lead to the conclusion that hydrogen occluded in the latter two forms is located, in atomic form, along lattice *dislocations*. The points of insertion of hydrogen atoms in such regions are, however, of unequal energy value. Most highly active points, i. e., points where insertion of a hydrogen atom is accompanied by the greatest gain of energy, are available during the process of crystal growth, i. e., during the electrodeposition. Unless they are occupied by H atoms at that *formative* stage, they will either be occupied by other extraneous impurities or become neutralized and disappear. Consequently, the most firmly held hydrogen, the co-H, can be taken up only in the course of the deposition. Hydrogen introduced in the form of atoms into a ready-made metal can be inserted only at points of lower activity: i. e., the in-H hydrogen.

Acknowledgment

One of us (D. G. Kelemen), having completed his Ph.D. thesis at Princeton University as fellow of the American Electroplaters' Society, and on the basis of work done in connection with A. E. S. Research Project No. 6, wishes to express his gratitude to the Society.

Washington Orders

Copies of NPA orders and publications may be obtained from National Production Authority, Washington 25, D. C., or from any of its local offices.

Appeals.—NPA Regulation 5 was amended on August 29 to permit appeal for adjustment of CMP allotments and materials allocations within 45 days of a contrary NPA decision.

Availability.—Issue No. 2 of the List of Basic Materials and Alternates, dated August 27, shows little change in the position of the metals, but considerable change as far as chemicals and other products are concerned. Chemicals of a variety of metals no longer appear in any of the subdivisions of the list, and probably have the same availability as the corresponding metals. Latest ratings on these and other chemicals not on the list may be had from the Chemical Division, N.P.A.

Group I, *materials in very short supply*, include copper, lead, selenium, tin, zinc, platinum, nickel, copper and nickel salts, hydrogen peroxide, polyethylene resins, sulfuric acid, hides and skins, corundum wheel grain, graphite electrodes, and rubber. Group II materials, *in approximate balance with demand*, controlled or otherwise, include cadmium, boric acid, formaldehyde, hydrofluoric and nitric acids, per- and tri-chlorethylene, cotton duck, carbon electrodes, and animal glue.

Construction.—A pamphlet, "Q and A on Construction under CMP" was issued on August 21.

Copper.—Manufacturers whose quarterly copper requirements are less than 4,000 lb should file CMP allotment applications with NPA field offices and not in Washington.

Amendment 3 to CMP Reg. 1 issued on August 22 deals largely with surplus supplies; Direction 3, amended on August 14, with monthly restrictions on placing controlled materials orders; Direction 6, issued on August 22, with right to specify allotment quarter in the manufacture of A products.

Amendment 1 to CMP Reg. 5 limits monthly orders for MRO items to 40 per cent of the quarterly quota.

According to Direction 4 to Order M-11, Copper and Copper-Base Alloys, August 31, no producer may put an order into production for shipment on or after October 1 until it has been converted into an authorized controlled material (ACM) order.

Laboratories.—Order M-71 dealing with priorities assistance was amended twice, on August 6 and 23. A company is now permitted to apply for aid for each of its laboratories separately or for all together. Getting materials for pilot-plant operations is made easier.

Motor maintenance.—NPA has issued a pamphlet, "Motor Care and Maintenance Techniques" that calls attention to conditions responsible for motor troubles and suggests a systematic program of maintenance.

Nickel.—Order M-14, Nickel, has been superceded completely by Order M-80, Iron and Steel-Alloying Materials and Alloy Products, and its Schedule 1, Nickel, both of August 15. The former controls the melting and processing schedules of anode and salt manufacturers and requires them to submit their schedules a month ahead of the month of manufacture for allocation by NPA. They must not deliver electrolytic nickel, anodes or salts except in accordance with NPA directives or allocation authorization or receipt of certification from persons who use 100 lb or less of nickel.

Schedule 1 retains the requirements of Order M-14 as far as use of nickel in plating is concerned.

Use of nickel-containing steel and alloys are dealt with in Schedule A to M-14, of the same date.

Resins for protective coatings.—NPA advised on August 15 that the biggest problem facing paint and lacquer manufacturers at the moment was shortage of phenol formaldehyde. The supply of phthalic anhydride is tightening (it was placed under Order M-32 on August 20), that of ethyl cellulose is short, and problems are developing in plasticizers. Urea and vinyl resins appear to be in adequate supply.

Rubber.—A number of provisions in Order M-2 dealing with consumption and inventories were liberalized on August 29. Increasing supplies of both natural and synthetic rubber are the reason. However, the specifications in Schedule A must now be adhered to strictly.

Selenium rectifiers.—Selenium, a by-product of copper refining, is becoming increasingly scarce, and present development of new sources is a long-term project. A system of allocating existing supplies is in the offing.

Small business.—The Office of Small Business of NPA on September 6 issued a 2-page pamphlet "Small Plant Housekeeping", which itemizes 69 points which should be checked periodically to maintain cleanliness, reduce accidents, and increase productive efficiency.

Tungsten and molybdenum.—The pure metals and their salts are now under separate control in Order M-81 issued on August 15. All users, except purchasers of fabricated parts, must obtain allocations from NPA, and inventories are limited to 60 days' requirements.

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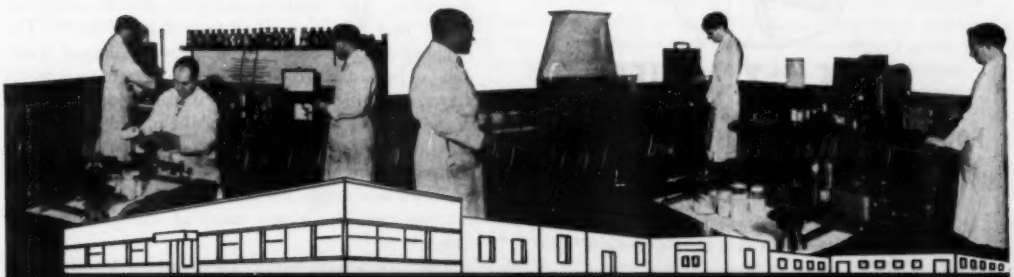

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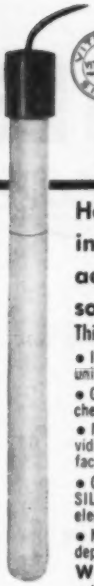

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Book Review

DR. HAROLD J. READ
Associate Professor of Metallurgy, Pennsylvania State College

INDUSTRIAL POLISHING OF METALS by Gerald F. Weill, 194 pages, 1950. Published for *Metal Industry* by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E. 1, England. Price, 21 shillings (postage 8 pence).

Treatises or even extensive review papers on the subject of this book have been notoriously few in spite of the importance of polishing in the metal-finishing industry. Mr. Weill's contribution to the literature is, therefore, a welcome addition even though in some respects it is a bit disappointing. He has succeeded well in summarizing British industrial practice so far as procedure, equipment and materials are concerned, but his treatment of such fundamental knowledge as we do possess is inadequate and heavily biased.

The chapter on the theory of polished surfaces turns out to be largely a discussion of testing methods for measuring surface roughness and brightness. When the author does attempt a theoretical discussion of polishing, he becomes so enamoured of the amorphous-metal postulate (Beilby layer) that he is led, in his enthusiasm, to make such incorrect statements as the one referring to the efficacy of the Beilby layer in promoting corrosion resistance (p. 31). This one-sided dissertation, in which none of the contrary evidence is presented, is completely misleading to the uninitiated. The work of Steer, incidentally, is given only as a series of photographs without the discussion which it deserves and which the reader requires for an understanding of the significance of the investigation.

The reviewer's shillalah may now be tossed aside, for he finds the remainder of the book interesting and informative. The historical survey is fascinating, and one wishes that more space had been devoted to it. The remainder of the book presents a well-balanced treatment of polishing procedures for a variety of metals and alloys, polishing techniques, materials and equipment, dust extraction and problems of the plating shop. The short concluding chapter on the estimation of polishing costs seems remarkably clear. Perhaps the best criterion of interest on the major part of the book is the reaction that one wishes many of the chapters were longer.

The variations in terminology between American and British technical jargon are, perhaps, nowhere more pronounced than in the field of polishing and buffing (even these terms do not have the same significance in the two countries). The author has provided a glossary which, to a large degree, solves the semasilogical problem, but there are a few terms which do not appear in the glossary, e.g., "fettle". This term is used in America, but never as a synonym for "snagging", the sense in which it appears on p. 63.

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readers' questions of general interest

Q. 125. We have encountered considerable spotting-out in the cadmium plating of sintered iron alloys, although various cycles have been tried to no avail. Can you recommend a suitable procedure?

A. Cadmium or zinc plating of sintered alloys is indeed difficult, and the plater is almost invariably plagued with spotting-out troubles. In rather extensive laboratory work done on this problem (PLATING **36**, 702, (1949)) several techniques were developed which overcame difficulties with copper, copper-nickel, and nickel-chromium cycles, but no cycle or combination of expedients was discovered which prevented spotting-out of zinc or cadmium coatings. In the latter cases, traces of copper salts (the work was done wholly on sintered brass alloys) seeped out of the pores, depositing black spots of copper by displacement on contact with the zinc or cadmium coating.

Mechanical work on the surface of the sintered metal is the most effective way of closing the pores before plating. A burnishing action is preferred, or if this is not possible, polishing with a compound designed to flow rather than cut. The parts should then be cleaned thoroughly, but acid-dipped only lightly to prevent reopening of the pores. The other techniques described in the paper referred to above, such as alternate hot and cold rinsing, final dewatering, etc., will also be of value in addition to burnishing, but cannot substitute for it.

Another approach to the specific problem presented, unfortunately of only academic interest today, would be to follow the mechanical treatment with a thin nickel undercoat to reduce the possibility of seepage of iron salts to the cadmium surface.—H. L. PINKERTON.

Q. 126. Is chromium plating of 12–14 per cent chromium steel done only for purpose of color matching or does it also serve to prevent pit corrosion?

A. In my opinion the quality of products made from chromium plated stainless steel, properly processed, is superior to that of products made either from unplated stainless steel or from copper-nickel-chromium-plated mild steel. Proper processing includes proper polishing and buffing before chromium plating, without which the corrosion resistance is lessened rather than improved. It also includes chromium plating, not chromium flashing. Anything short of one minute in the chromium tank, and two minutes if the parts are recessed, is a waste of effort. We run our parts for 3–4 minutes.

Improper polishing and buffing is an important factor causing pit corrosion. However, even with proper polishing and buffing, chromium plating is necessary to stop discoloration.—H. E. HEAD.

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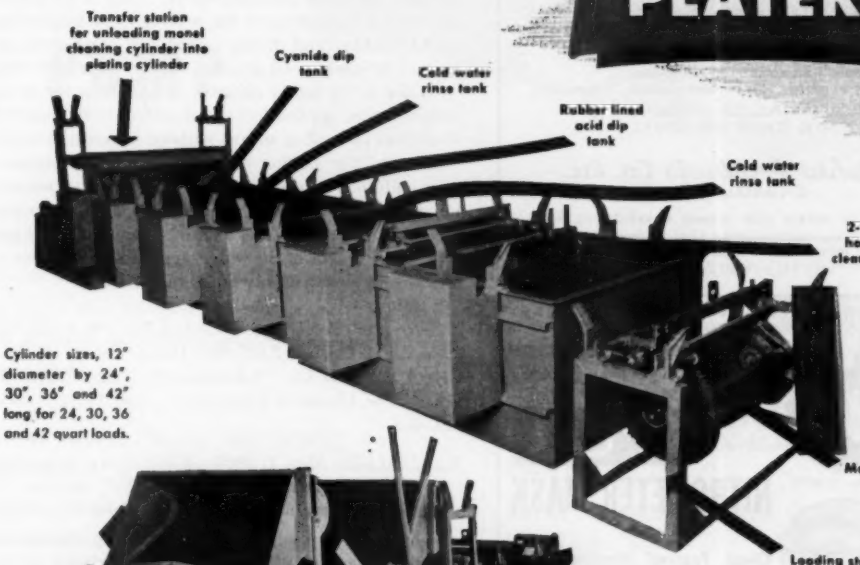
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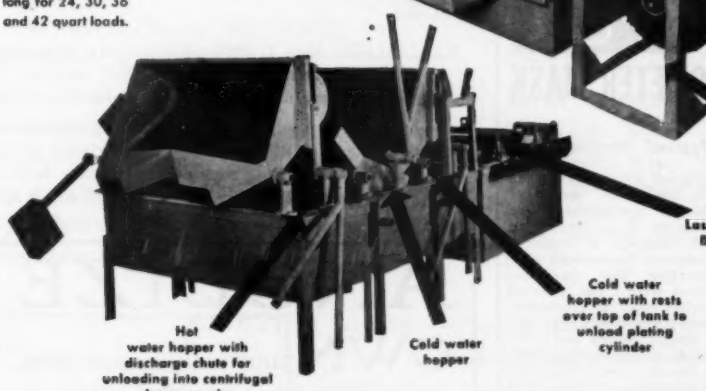
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Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,540,376, February 6, 1951—Buffing or Polishing Composition—Theodore F. Onkey.

The composition of this invention represents a complete departure from present practice. This invention is based upon my discovery that an ideal buffing or polishing operation can be performed when the abrasive composition is compounded so that it can be applied to the work and retained thereon in such a manner as to prevent transference of any substantial part of the composition to the polishing wheel . . . is of a non-greasy nature and . . . will leave the work so clean that subsequent washing and drying operations, heretofore customary in commercial practice, can be dispensed with.

CLAIM 2. A liquid abrasive composition for metal adapted to be applied to a metal surface to be removed therefrom by buffing means without substantial transference to the buffing means consisting of abrasive grits uniformly dispersed in an aqueous vehicle containing diglycol stearate as a suspending agent, a quantity of glue in an amount from about 0.5 per cent to 1.5 per cent of the weight of the water, and a sufficient amount of water to yield a highly liquid dispersion.

4 claims.

References cited: U. S. Patents 1,822,596; 2,032,372; 2,055,220; 2,185,262; 2,327,900. British Patent 198,807. Glycol Products Co., "Chemicals by Glyco", pp. 31, 116. "The Chemical Formulary", Vol. IV, pp. 403, 412, 413.

No. 2,551,035, May 1, 1951—Electrostatic Deposition of Elastomer Material—E. P. Miller, assignor to Ransburg Electrocoating Corp. Indianapolis, Ind.

CLAIM 2. The process of forming an elastomer-coated product comprising the steps of creating in the atmosphere of a working zone an electrostatic field of substantial length having a local region in which the

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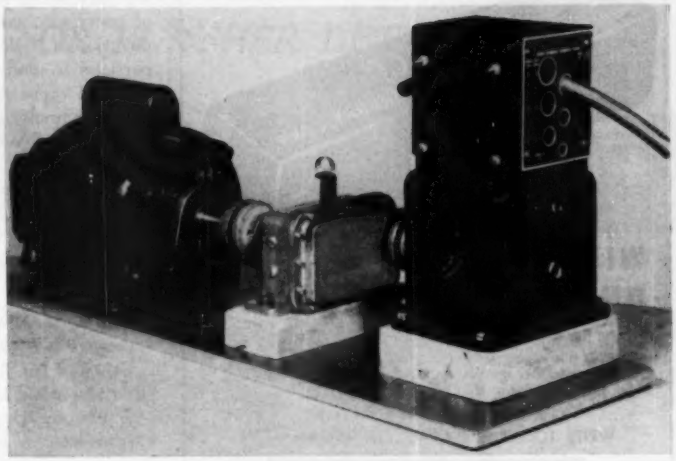

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WHAT OTHER ADVANTAGES DOES THE ADDITION AGENT PUMP OFFER?

First, it is self-priming. Second, one pump operates one to four individual lines from the supply tanks to the plating tanks. Third, it pumps any liquid that does not affect rubber, neoprene or tygon tubing (liquid does not contact anything but the tubing). Fourth, it provides any desired rate of flow from 12 oz. to 27 gals. per hour. Obviously, the addition agent may be diluted as necessary for the proper flow rate.

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Patent Abstracts

electrical gradient is adequate to produce ionization of the atmosphere, creating a vapor of a volatile coagulant in said working zone, moving a base material through said field in the direction of its length, directing particles of liquid elastomer material in the form of spray into said electrostatic field generally in the direction of its length, said field acting on said liquid particles to elongate and deposit them on said base, and said vapor and said field acting to coagulate said elastomer material to form a spongy, mat-like finish on said base material.

6 claims, 1 figure.

References cited: U. S. Patents 1,423,525; 1,575,165; 1,841,076; 1,958,406; 2,047,525; 2,191,827; 2,270,341; 2,302,289; 2,303,341; 2,323,191; 2,333,143; 2,334,648. British Patents 291,471; 550,391.

No. 2,551,342-4, May 1, 1951—Method of Electrodepositing a Metal Layer on Rubber—E. L. Scholl, assignor to United States Rubber Company.

CLAIM of No. 2,551,342: The method of bonding an electrodeposited layer of metal to rubber so as to secure a strong bond therebetween, comprising the steps of providing a layer of rubber, treating a surface thereof with phosphorus trichloride, then coating the treated surface with electrically conductive particles to render it electrically conductive and electrodepositing directly thereon a layer of metal selected from the group consisting of iron and nickel in direct contact with the rubber so that the metal is bonded directly and strongly to the treated surface of the rubber.

CLAIM of No. 2,551,343. . . . treating a surface thereof with chloroacetyl chloride . . .

CLAIM OF No. 2,551,344. . . . treating a surface thereof with bromine . . .

1 claim in each patent.

References cited, in all: U. S. Patents 889, 807; 1,624,575; 2,078.910; British Patent 701; in No. 2,551,342: U. S. Patents 225,186; 1,126,211; 1,774,324; 2,078,911; in No. 2,551,343: U. S. Patent 2,078,911; British Patent 429,557; in No. 2,551,344: French Patent 844,367.

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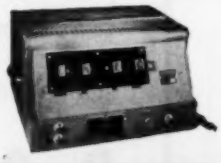

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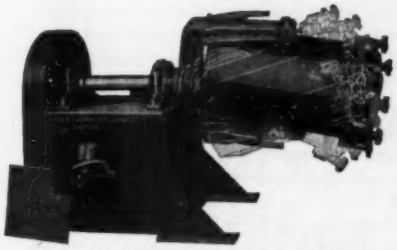

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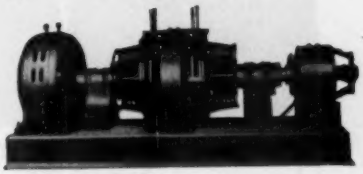

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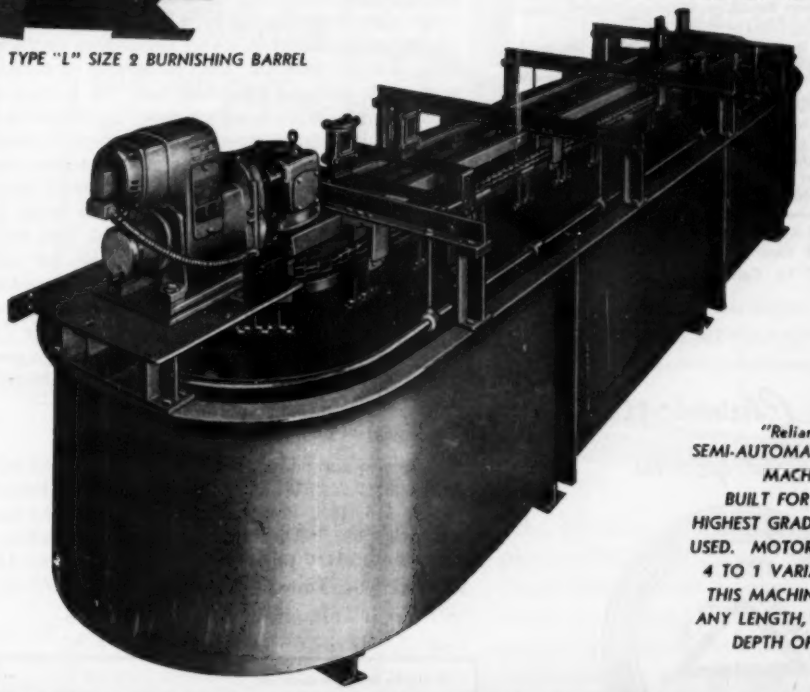

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Patent Abstracts

No. 2,553,449, May 15, 1951—Process for Obtaining by Galvanic Means a Coating for Protecting Magnesium From Corrosion—H. M. Freud, Nanterre, France.

CLAIM 1. A process of providing a protective coating upon a metallic article composed substantially entirely of magnesium and magnesium-base alloy, by galvanic action, which comprises placing such an article to be protected as anode in an acid electrolyte having a *p*H value above 2.5, but not substantially above 3.95, and such electrolyte being incapable of chemically attacking metallic magnesium and said electrolyte consisting essentially of water containing a soluble manganese compound of chromic acid, said electrolyte also containing a small amount of at least one substance containing the anion of a mineral acid which mineral acid would in higher concentration be capable of chemically attacking magnesium, such acid being selected from the group consisting of sulfuric acid, nitric acid and phosphoric acid, the amount of such mineral acid ion being not more than 0.1 per cent of sulfate ions, not more than 0.5 per cent of nitrate ions, not more than 0.2 per cent of phosphate ions, and placing a cathode in said electrolyte, but out of physical contact with said anode, such cathode being an electrically conductive material more noble than magnesium, electrically connecting said anode and said cathode outside of said bath, the electrode potential of the magnesium electrode in said electrolyte relatively to the hydrogen electrode being not over 1.1 volts, continuing the flow of said current until a protective film of substantial thickness has been formed on said anode.

6 claims, 3 examples.

References cited: U. S. Patents 1,838,273; 2,052,962; 2,206,028; 2,224,528; 2,356,575; 2,463,483. British Patent 515,648. French Patent 702,266. German Patent 471,053. Alien Property Custodian Publication 297,191 (May 18, 1943). Metaux & corrosion **14**, 87–91 (1939). Trans. Electrochem. Soc. **90**, 503–507 (1946).

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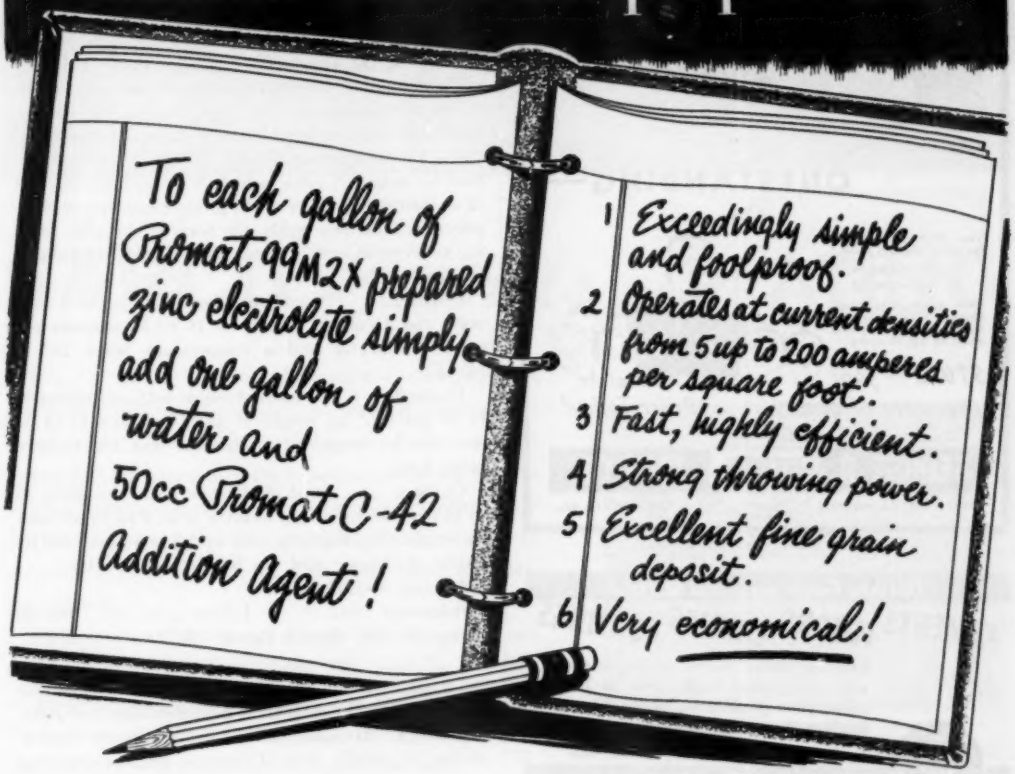
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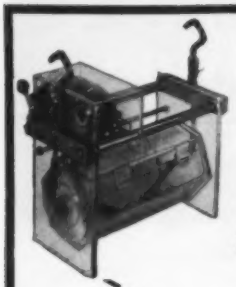

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Patent Abstracts

No. 2,553,937, May 22, 1951—Method of Electrolytically Polishing Aluminum and Its Alloys—Jos. Patrie, assignor to Compagnie de Produits et Electrometallurgiques, Alais Froges et Camargue, Paris, France.

CLAIM 1. In a method for electrolytically polishing and brightening articles consisting of at least for the major part aluminum, the step effecting the electrolytic polishing and brightening treatment below 20° C (68° F) in an electrolysis bath containing 30 to 45 per cent by weight of nitric acid and a significant amount of at least one member of the group consisting of phosphoric and chromic acids, the total of the acids ranging between 43 and 79 per cent by weight, the balance being water.

CLAIM 2. . . . under a current tension of 3 to 7 volts and a current density of 10 to 50 amperes per square decimeter and a temperature below 20° C (68° F) . . . .

CLAIM 3. . . . in an electrolysis bath containing 30 to 45 per cent by weight of nitric acid and 13 to 34 per cent by weight of phosphoric acid, the balance being water.

CLAIM 4. . . . in an electrolysis bath containing 35 to 45 per cent by weight of nitric acid, 8 to 25 per cent by weight of phosphoric acid, and 3 to 10 per cent by weight of chromic acid, the balance being water.

4 claims, 4 examples.

References cited: U. S. Patent 2,462,197. British Patent 504,026. French Patent 798,721.

No. 2,554,943, May 29, 1951—Electroplating Apparatus —Q. B. Farmer, assignor to Bethlehem Steel Company.

CLAIM 1. An apparatus for the continuous electroplating of metallic strip of different widths comprising a tank containing a plurality of vertical anodes aligned in tandem with main faces of the anodes in parallel relationship, said anodes being fixed against lateral movement and having a width substantially equal to the mean width of the strip to be electroplated and

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8—125 A., Hobart, 6 volts.

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1—1000A., 15 V. Gen. Elec.
1— 300 A., 15 V. Star
1— 750 A.,20 V. M. G. Corp.
1— 800 A., 22/33 V. Gen. Elec.

24 VOLTS
2—1500 A. Century
1—2500 A. Gen. Elec.
2—3000 A. Electric Products

1— 600 A., 24 V. Reliance
1— 200 A., 25 V. Star
1— 300 A., 25 V. Star
1— 175 A., 25 V. Cr. Wh.

32 to 60 VOLTS
1— 500 A., 32 V. West.
2— 100 A., 30 V. Gen. Elec.
1— 200 A., 30 V. West.
2— 200 A., 32 V. Gen. Elec.
2—1500 A., 32/40 V. Century
1—1000 A., 33 V. Gen. Elec.
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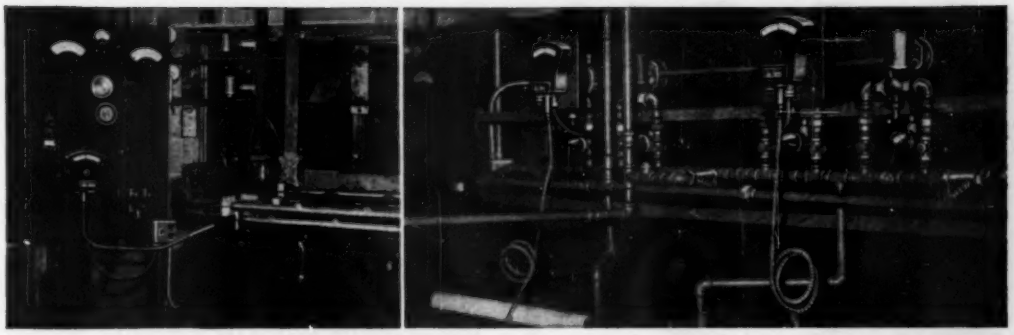

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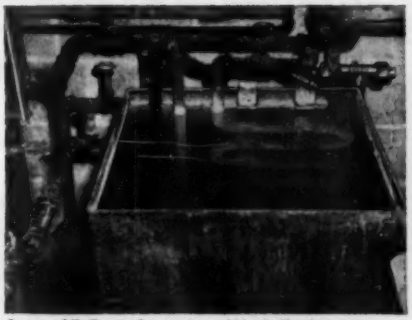

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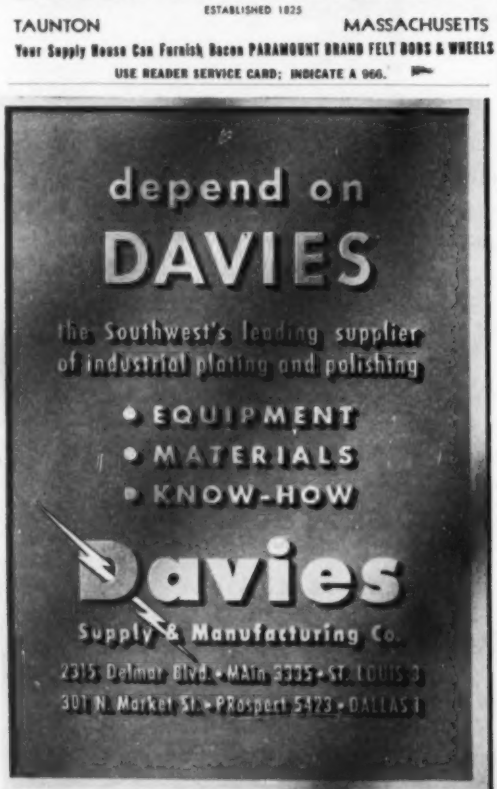
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Patent Abstracts

not less than two narrower vertical anodes, one of said narrower anodes being reciprocally laterally adjustable from one side of said tank to a point at which the vertical center line of the anode is in substantial alignment with the vertical center line of the tank and another of said narrower anodes being reciprocally laterally adjustable from the opposite side of said tank to a point at which the vertical line of the anode is in substantial alignment with the vertical center line of the tank, said narrower anodes having a width less than one-half the width of the fixed anodes, means to reciprocally laterally adjust the narrower anodes and means to move the strip between and past the anodes.

6 claims, 9 figures.

References cited: U. S. Patents 830,093; 895,164; 1,242,695; 1,952,762; 2,174,071; 2,317,242; 2,382,018; 2,395,437; 2,399,254; 2,461,556. British Patent 551,841; 555,431. Haas, Metal Ind. (N. Y.) **37**, 24, 25, 26 (January, 1939).

No. 2,555,375, June 5, 1951—Process of Plating Bright Silver Alloy—W. P. Reummler, assignor to Battelle Development Corporation.

CLAIM 4. An electrolytic bath for codepositing silver and antimony as a bright alloy coating containing 0.08 to 12.0 per cent by weight of antimony and the balance silver, consisting essentially in aqueous media at a *p*H of from 11.5 to 12 of about 30 grams per liter of silver cyanide, from 30 to 50 grams per liter of potassium cyanide, from 20 to 250 grams per liter of potassium tartrate, from 3 to 5 grams per liter of potassium hydroxide, from 5 to 36 grams per liter of potassium antimonyl tartrate, and about 10 grams per liter of potassium carbonate.

NOTE. . . . a current density of from 5 to 90 amperes per square foot . . . heating the electrolyte to a temperature between 70 and 140° F.

4 claims.

References cited: U. S. Patents 487,176; 850,944; 1,779,809; 1,782,092; 1,892,051; 2,110,792. British

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- ¶ What are four easy ways to improve the average rinse tank? *See page 10.*
- ¶ What rinsing fault is "an invitation to trouble" in the plating of high-carbon steel? *See page 11.*
- ¶ Why is it better to clean steel with reverse current than with direct current? *See pages 12 to 14.*
- ¶ What causes hydrogen embrittlement during electrocleaning? What is the remedy? *See pages 15 and 16.*
- ¶ One part chromic acid in 1,000,000 parts of cleaning solution—does that spell D-A-N-G-E-R? *See page 16.*
- ¶ How can an ordinary electrocleaning cycle be transformed into an exceptionally good cycle? *See Cycle E on page 23.*

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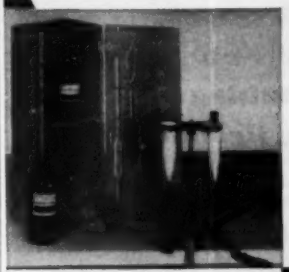

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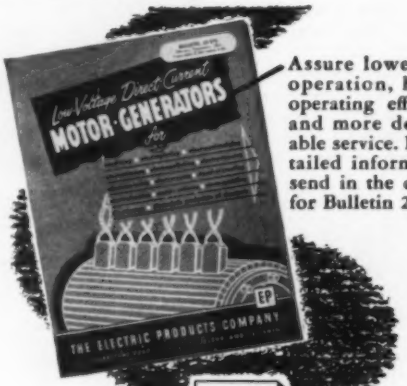

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Patent Abstracts

Patent 589,164. Metal Ind. (London) **55**, 253–256 (September 15, 1939).

No. 2,556,017, June 5, 1951—Electrolytic Method and Apparatus for Cleaning Strips—E. E. Vonada.

CLAIM 3. The method of continuously cleaning strip electrolytically which comprises passing the strip between a pair of anodic electrodes, passing the strip between a pair of cathodic electrodes, connecting a direct-current supply between said strip and said anodic electrodes, connecting a second direct-current supply between said strip and said cathodic electrodes, and periodically reversing the polarity of the electrodes.

3 claims, 2 figures.

References cited: U. S. Patents 943,188; 1,191,386; 1,865,470; 2,264,857; 2,317,242. Austrian Patent 133,216. Norwegian Patent 60,198.

No. 2,556,635, June 12, 1951—Electrolytic Refining of Copper—S. Skowronski and M. M. Mosher, assignors to International Smelting and Refining Company.

We have discovered that animal glue and casein when used together as addition agents possess unusual advantages in the refining of copper electrolytically; and in fact this new combination is distinctly superior to the combination of glue and "Goulac" which is perhaps the best combination of addition agents for copper refining heretofore known. Much less glue and casein are required to produce cathodes of good quality when the two are used together than when either is used in combination with other agents such as "Goulac". The current efficiency . . . is very markedly superior. . . . The quality of the cathode (smoothness and freedom from inclusions of electrolyte) . . . is equal if not superior to that obtained with any heretofore-used addition agent or combination, and is very much superior to the deposit resulting from the use of glue or casein alone.

CLAIM 2. In the electrolytic refining of copper, involving passing an electric current between anodes of copper to be refined and cathodes of pure copper immersed in an electrolyte comprising an aqueous solution of cupric sulfate and sulfuric acid, the improvement which comprises adding to said electrolyte from ¾ to 2 ounces of casein and from ¼ to ¾ ounce of animal glue for each ton of copper deposited on the cathodes.

5 claims.

References cited: William Blum and George B. Hogaboom, "Principles of Electroplating and Electroforming", 2d ed. (1930), p. 216. The Electrochemical Society, "Modern Electroplating" (1942), p. 158.

No. 2,556,706, June 12, 1951—Method of Forming Masks for Articles Having Intaglio Designs—S. R. France, assignor to General Motors Corporation.

CLAIM 1. The method of forming a mask for plastic

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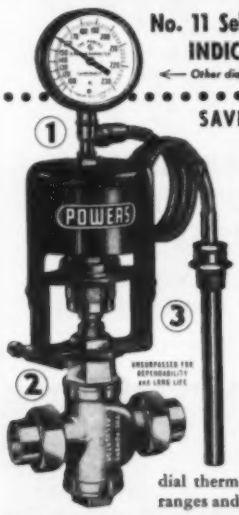

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Patent Abstracts

articles having intaglio designs of appreciable depth thereon, the steps comprising subjecting the article to a vacuum of not more than 25 microns' pressure, vaporizing metal onto the intaglio design of the article by metal evaporation while maintaining said vacuum, removing the metal-coated article from the vacuum, and electroplating thereon another metal in a thickness sufficient to yield the desired strength, removing the reproduced surface from the surface of the article on which it was deposited, and cutting away portions of the reproduced surface for the forming of a plurality of separate portions of the desired shape and then rigidly joining the desired portions of said article in spaced relation to one another whereby the completed mask has a high fidelity of outline and shape for the intaglio design on the original surface.

3 claims, 6 figures.

References cited: U. S. Patents 484,582; 974,895; 1,892,755; 1,994,668; 2 151,457; 2,343 031; 2,394,930. E. A. Ollard, Metal Ind. (London) 49, 239, 240 (September 1, 1936).

No. 2,560,534, July 17, 1951—Method of Operating Continuous Electroplating Systems—O. E. Adler, assignor to National Standard Company.

CLAIM. A method of electroplating a continuous zinc coated steel base which comprises passing said base through a plating bath of cyanide and copper in which the base is cathode of an electric circuit, and thereafter passing said base through a second bath of cyanide and copper in which the base is an anode of said circuit, maintaining the base free from any solid electric contact during its passage through said bath to give an efficient plating operation and establishing a very high current density in the second bath whereby only a very slight electrolytic removal of plated metal occurs in said bath.

1 claim, 1 figure.

References cited: U. S. Patents 1,068,410; 1,509,101; 1,517,910; 1,745,912; 2,078,869; 2,293,810. British Patent 434,116.

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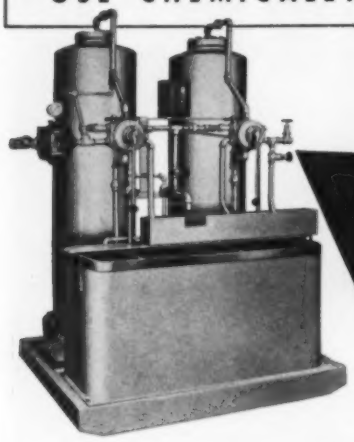

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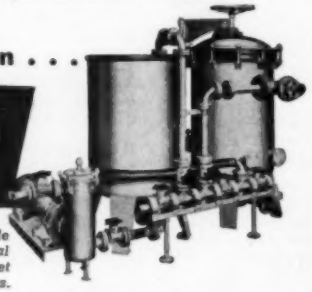

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A. E. S. News

A Demonstration Night

The report from the Melbourne Branch in this issue should be of interest to Program Chairmen of other Branches and their committees. It describes a new kind of program, which proved extremely successful in Melbourne. An attendance of about 150 per cent of the membership was obtained without special advertising.

A Job Well Done

"The men of the Buffalo Branch are to be congratulated on having done such a splendid job on the recent A. E. S. Convention, especially in view of the short time given them to take care of all the details attached to running a Convention of this size".—RAY BERGHOLD, President of the Rochester Branch.

Research Committee Appointments

Dr. Donald Price, Director of Research of Oakite Products, Inc., New York City, who was appointed Vice-Chairman, Research, by the late Chairman, Guy M. Cole, has succeeded him as Committee Chairman.

Clyde Kelly, of B. Mercil & Sons Plating Company, Chicago, Ill., is the new Vice-Chairman, Finance. He has appointed Robert J. Racine, Manager of Industrial Sales of Wyandotte Chemicals Corporation, Wyandotte, Mich., Research Finance Supervisor for the State of Michigan.

The Executive Board has appointed Dr. W. A. LaLande, Jr., Director of Research, Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., to fill a vacancy on the Committee.

We wish them success in their new posts.

Acknowledgment Received

Mr. David X. Clarin, in a letter to the Executive Secretary from Piraeus, Greece, thanks the Delegates for the telegram sent to him during the Buffalo Convention. He says he is "the healthiest looking American to visit" the Middle East, but he still tires too easily. Best regards go to all his friends.

The Editorial Board

Mr. B. C. Case of Hanson-Van Winkle-Munning Company, who is moving from Detroit to Matawan, N. J., and Dr. R. A. Schaefer of the Cleveland Graphite Bronze Company, who is now Third Vice-President of the Society, have resigned their memberships on the Board after many years of service. They have performed faithfully and well, and their well-considered advice will be missed.

Two capable men have joined the Board. Both, L. M. Morse of the Chrysler Corporation, Detroit, and L. B. Sperry of Doehler-Jarvis Corporation, Grand Rapids, are intimately familiar with plating developments in the automotive industry.

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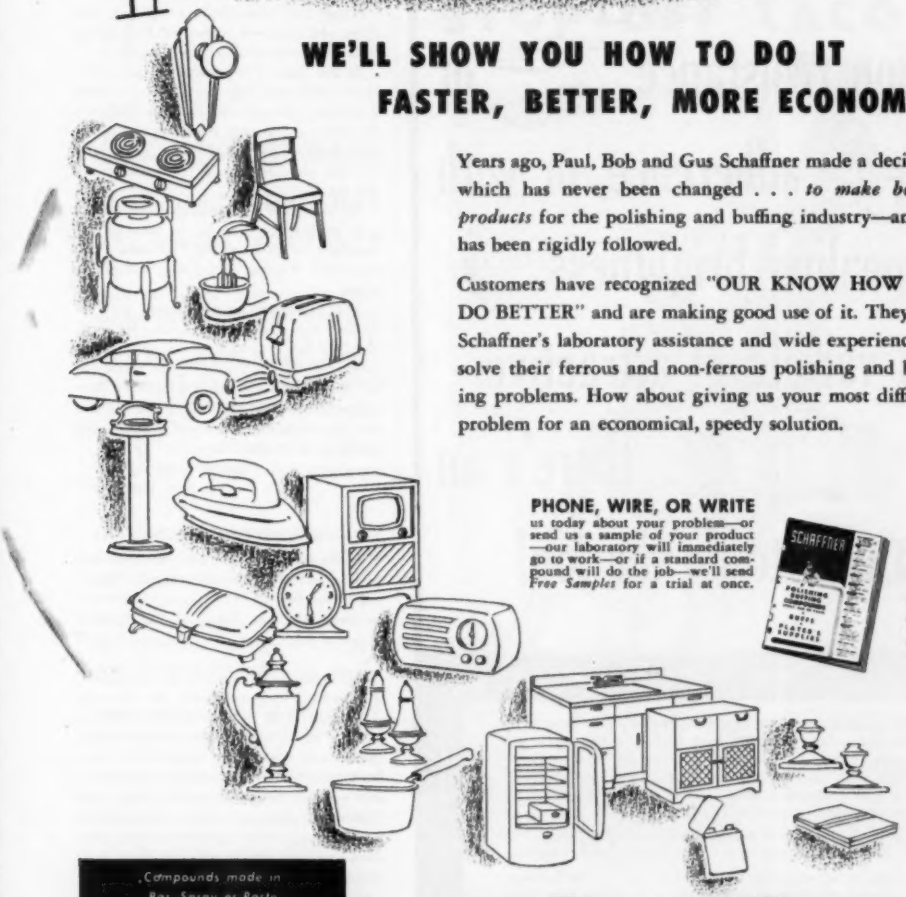

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Branch News

BRIDGEPORT BRANCH

Thirty-one members and guests were present at the meeting on May 11 at the Harry W. Congdon Post. After PAST PRESIDENT ANTHONY J. CHENIS had introduced the new president, MEDERICK J. BRASSARD, he was thanked by the Branch for a successful administration.

Three new members were elected, and three old members submitted their resignations, having left the plating field.

It was decided to present all past presidents with Past Presidents' Pins; to hold a summer outing, with EUGENE PHILLIPS as chairman; to send delegates and alternates to the Convention uninstructed; and to hold no meetings in June, July and August.

At the end of the meeting, refreshments and sandwiches were served through the courtesy of JOSEPH W. GANIM, The Chemical Plating Company, Stratford, Conn.

The 128 members and guests who attended the Dinner-Dance on May 25, Fairfield Inn, Fairfield, Conn., greatly enjoyed the affair. Thanks go to RAYMOND W. GORAL and HENRY STEVENS for door prizes and to WILLIAM EHRENCRONA and his committee for successful management and a profit of $65.20.

JOSEPH G. STERLING
Secretary-Treasurer

MELBOURNE BRANCH

A record number of 180 members and visitors attended the 65th Regular Meeting of the Branch, which took the form of a Demonstration Night at the Laboratories of Electrolux Pty. Ltd., on August 16.

After MR. O'DELL, General Manager of Electrolux, had welcomed the Branch, PRESIDENT BOB TAYLOR explained that a number of working exhibits had been prepared, and were being operated by men competent and willing to answer questions. He pointed out that nickel plate submitted by members would be tested during the evening, and he hoped that when members saw how simple some of these tests were, they would adopt them in their own shops.

Items being displayed were classified in the following manner:

Testing of Deposits.—Jet and drop tests, the Magnegage and Synchrotac were used to test thickness; twisting, bending and ball peening were employed for adhesion testing; salt spray and humidity demonstrations showed how corrosion resistance could be tested; ferroxyl tests were used to determine the extent of porosity of nickel plated steel samples; and the Gardam evaluator was employed to compare brightness and trueness of surfaces.

Control.—Numerous Hull-cell panels,

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Easy to apply—can be brushed, dipped or sprayed with equal success.

Possesses rapid air-drying qualities, reducing drying time between coats and in preparation for racking.

Has exceptional adhesive qualities but can be removed easily after plating.

Has good dielectric strength resulting in a clean line of demarcation with no loss of current

Assures extreme accuracy, with no possibility of a lacquer etch on precision-lapped finishes.

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many plated during the night, showed the effect of impurities in solutions; *p*H tests and plating-bath analyses (volumetric, electro-analytic, and with the photoelectric colorimeter) were carried out, and details of analytical methods were given.

Processes.—Great interest was shown in the P.R. copper plating unit which was producing almost mirror-bright deposits from a high-speed copper solution. Graphs and the results of surface measurement before and after plating were used to show the smoothing effects. A Perspex cell was used to illustrate the advantages of diaphragm plating; steel and other small articles were electropolished; and there was a display of anodizing, dyeing, and photographing on aluminum.

General Interest.—The large, modern electroplating shop was open for inspection; there was a demonstration of the principles involved in refrigeration; other displays showed electroplating literature, specifications and museum samples.

Supper, provided by Electrolux Pty. Ltd., furnished an opportunity for members to renew old and make new friendships. President Taylor congratulated Stuart Anderson on winning the nickel plating competition, and First Vice-President Herbert Littauer thanked the management of Electrolux for the manner in which they had co-operated so splendidly with the Branch in arranging this night. Rowland H. Keller

Honorary Secretary

LOS ANGELES BRANCH

The annual Branch Picnic, held August 12 at South Gate Municipal Park, was a highly successful affair, and compliments are due to Dexter Halldin and his committee for the arrangements.

The baseball game came first on the schedule. Captain Milton Crompton led the platers to a sparkling 15–12 pitchers' duel, winning over the suppliers. Capt. Fred Raymond's suppliers group, although liberally supported by ringers, had apparently been over-trained and had left their ball game in the bar at Rodger Young Auditorium.

The umpire was, as usual, Don Bedwell, whose seeing-eye dog led him to his station. There was a strong comment that the umpiring would have been better had the seeing-eye dog stayed on the field. The suppliers' group, a bunch of sore-headed losers, made extremely nasty comments after the game to the effect that the next time they received their large shipments of nickel salts (one-hundred-pound bag) they were not even going to put it on display for the platers to look at, which has been their custom for the past year or so. The score of the game, however, should be an indication to the rest of the plating world that the platers in Los Angeles are a fearless group, and are not to be intimidated by the possibility of having their water cut off completely. They have been operating for so long without help from anyone that any change will have to be for the better.

There were other games for all ages, free ice cream and pop for everyone, and by the simple means of handing out tickets, we didn't have to feed half of South Gate for free. So far as is known now, all the people who attended (two hundred plus) had, if we may coin a new term, a swell time.

G. Stuart Krentel, *Secretary*

ROCKFORD BRANCH

The annual Branch Play Day was held August 9 at the Mauh-Nah-Tee-See Country Club.

Golfing started at 2:00 P.M. and continued through the afternoon until dinner, which was served at 7:45 P.M. Putting contests were held near the Club House for those who didn't play golf.

Leonard Weeg discussed briefly the waste-disposal problem of our area and informed us of the coordination between the city and industry in Rockford on the problem.

Attendance and golf score prizes were awarded. The attendance was 57, including many from out of town.

Ken Kieselburg,
Secretary-Treasurer

SAN FRANCISCO BRANCH

The meeting on July 21 was devoted entirely to business matters.

E. M. Alexander and W. S. Pankey were appointed to arrange for the entertainment and for the reservations and dinner arrangements, respectively, at the Alameda meeting in July.

President George H. Cook's appointments of Fred Lane, Jack Hite and

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Branch News

ELDO ALEXANDER as Delegates and LOUIS DELAMOTHE, FRED DARTT and STUART PANKEY as Alternates during the fiscal year 1951–1952 and of Los Angeles Branch as the San Francisco Branch's proxy at the Buffalo Convention were approved. It was decided that nominations for Branch officers be made in February, that election be held in March, and that the new officers take office in April.

It was voted to instruct the proxy to vote *no* on the amendment to raise the per capita tax for the following reasons: (1) that the Society submit a budget for 1951–1952; (2) that the Research Fund derive any moneys from large companies who will benefit from the Research Program; (3) that PLATING be improved; more direction to the small shops, more practical articles; more reader interest.

HORACE J. SMITH,
Secretary-Treasurer

SYDNEY BRANCH

The 74th regular meeting was held on July 12 in the Trust Building, King and Castleneagh Streets.

MR. G. R. TREVENA, a fellow member, of Austral Industrial Products, gave a talk on his recent trip to England and the Continent. After describing what he saw in various plating plants and comparing plating practices in these countries with those in Australia, he answered questions put to him by members.

We were then entertained by some very good travelogue films taken and described by Mr. Trevena. The members were unanimous in their praise of the films and in their thanks to the speaker.

W. W. PATERSON,
Secretary-Treasurer

SYRACUSE BRANCH

The June dinner meeting was held at the Arion Club on June 18. A full-course porterhouse-steak dinner was served 47 members with all the beer they desired.

Many of the members took the opportunity to hear the Arion "Ladies' Chorus" rehearsing. Some of the members were invited to attend and sing with the male chorus since their voices proved to be of such good quality.

The committee, composed of IVAN HOOD, BOB COLVIN, and ED HOLLISTER, was responsible for the very good time had by all.

Two new members were accepted.

LINDLEY S. WOOD,
Secretary

TORONTO BRANCH

On May 12 the Branch held its Annual Regional Meeting in The General Brock Hotel, Niagara Falls, Ontario.

The educational program in the afternoon was directed by BRANCH PRESIDENT FLOYD WILLIAMS, and the speakers and their subjects were as follows:

Mr. A. C. Benning, The Harshaw Chemical Company, "Impurities in Nickel Plating Solutions"

Dr. H. L. Kellner, Lea Manufacturing Company, "Evaluation of Buffing Compounds"

Mr. G. A. Lux, Oakite Products, Inc., "Some Fundamentals of Alkaline Cleaning"

At 7 o'clock, an excellent dinner was served in the Crystal Ballroom. It was followed by some really good entertainment (thanks B. C.) and dancing.

The Branch was very pleased to have so many friends from neighboring Branches at the dinner, and also to have A. E. S. PRESIDENT WILLIAM NEILL as its guest. It was our best Regional Meeting yet, with full credit going to all the members who worked hard to make it a success.

A. L. COXHEAD,
Correspondent

TORONTO BRANCH

The regular meeting of the Branch was held on June 8 in the Royal York Hotel, bringing to a close the meetings for the first half of 1951.

With no speaker scheduled, a general discussion gave the members and guests an opportunity to air some of their problems.

As might be expected when platers get together, there were many of them, but top problem of the evening was how to separate a million or so small rivets from a million or so of their brothers that were only one or two thousandths inch different in size. There were no easy ways to that one.

Following the discussion, retiring PRESIDENT LLOYD WILLIAMS introduced the president for the coming year, JOHN ACHESON, and turned the meeting over to him. John is a founder member of the Branch, a past president, and now in his fortieth year as a member of the A.E.S.

Other officers for the coming year are:

Vice-President—C. TURNER
Secretary—W. MARK
Past President—L. WILLIAMS
Treasurer—L. WRAY
Sergeant-at-Arms—A. STACEY
Entertainment Director—B. CAMERON
Librarian—D. WALKER
Correspondent—A. COXHEAD
Trustees—A. SEVERS, G. C. MCDONALD, R. W. STEPHENS, C. REID

A. COXHEAD,
Correspondent

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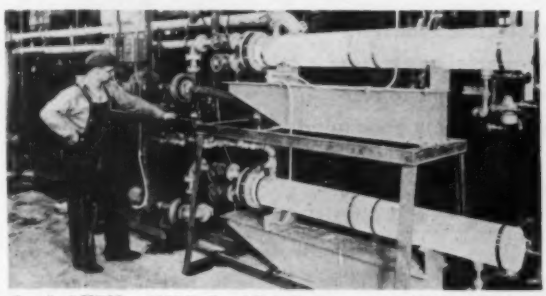

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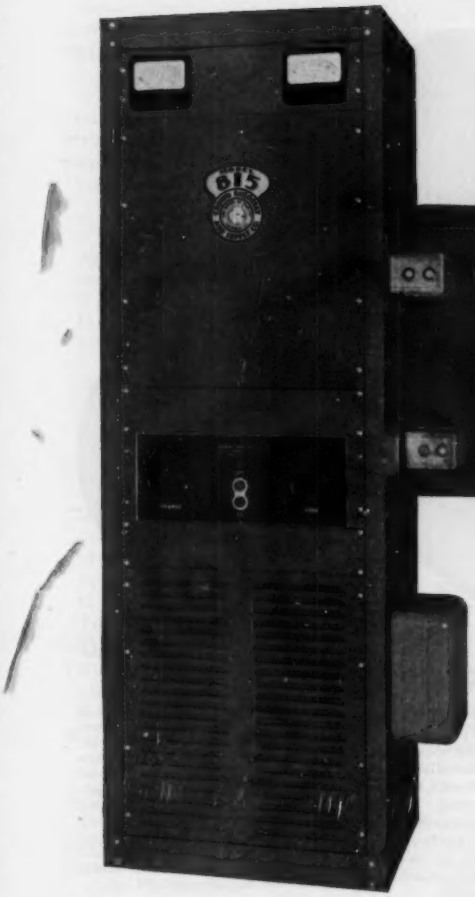

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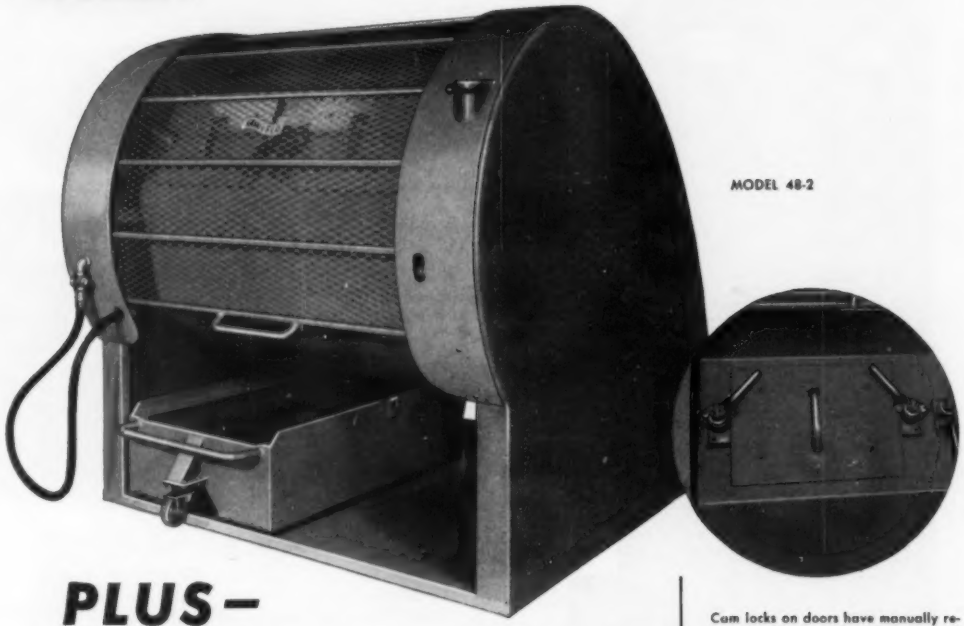

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Grav-i-Flo Tumbling Machines are designed to produce more work in less floor space. That's why so many companies have chosen Grav-i-Flo to handle all their tumbling needs. These manufacturers have compared Grav-i-Flo to other tumbling machinery and have found—First: that Grav-i-Flo machines, in each model, occupying the same floor space, have a 31% to 80% greater capacity; Second: that Grav-i-Flo machines cut from 15% to 25% faster; Third: this shortened processing cycle permits reduction in the required number of machines for an installation, thus benefiting capital investment, floor space and production time; and, Fourth: Grav-i-Flo tumbling machines in all models have such exclusive features as advanced design on door locks and safety guards, and cylinder removal for easier maintenance.

Cam locks on doors have manually released safety stops for pressure relief.

New Grav-i-Flo machines available in a number of models to meet all tumbling requirements. Compartments furnished ½" plate unlined or ¼" plate rubber lined. Reduced voltage control on magnetic starter. Lever or push-button switch. Limit switch on safety guard. 220-440 volt, 3 phase, 60 cycle motor with magnetic brake. Water attachment with hose. Counterbalanced safety guard. Hoist pan has tubular yoke with manually operated lock.

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Membership Report of the A. E. S.

Elections

BUFFALO: H. H. Baker, C. H. Crowl, G. J. Kinney, F. L. Klaiber

LOUISVILLE: L. O. Dunavan

NEWARK: E. Brown, A. Cole, S. P. Amerspek, D. C. Hamilton, Jr., W. A. Sterner

NEW YORK: C. Lotti, J. Lustgarten

TWIN CITY: David Smith

Reinstatements

NEWARK: W. J. Jancik

PITTSBURGH: E. T. Busch

TWIN CITY: W. A. Huntley, R. H. Peterson

Transfers

J. W. Baker, Jr. to Cleveland; E. M. Smith from Detroit to Pittsburgh; H. P. Wright from Detroit to Philadelphia; W. Fowler to Detroit; R. E. Collins from Detroit; J. Miller from Newark; S. L. Boyar from Newark to New York; J. L. Hosking from Newark; R. E. Watkins, Jr. from Pittsburgh; E. H. McCoy from Twin City

Resignations

BALTIMORE-WASHINGTON: H. J. Lebherz

CLEVELAND: G. R. Kingsbury, A. C. VanSchelt

DETROIT: A. H. Beebe, Sr., H. H. Devereux, J. E. Kasper, J. H. Lindsay, H. J. McGowan, Jr., C. H. Nehls, S. B. Twiss

MELBOURNE: F. S. Ward

TWIN CITY: C. A. Bowman, R. A. Bowman, M. A. Kantar, N. J. Morgenroth, E. E. Revell

WATERBURY: F. R. Kellogg

Suspensions

BALTIMORE-WASHINGTON: W. E. Hough, J. F. McCann

CLEVELAND: R. E. Sagendorf

MELBOURNE: H. P. Cotter, W. H. Hawley, G. McFadyen

SOUTHEASTERN: C. M. Cartledge, J. B. Cowen, M. H. Dent, E. R. Hines, J. A. Jones, R. E. Norman, R. D. Norman, M. H. Rogers

SYRACUSE: H. J. Crouse, A. D. Douglas, R. J. Helgenberg

TOLEDO: F. Binkley, C. Cunningham, G. Norton

Deaths

DETROIT: Guy M. Cole

TORONTO: L. S. Williams

Membership Competition

Branch	Membership Apr. 1, 1951*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Chicago	409	29	+26½	+ 6.5
New York	279	13	+15	+ 5.4
Boston	151	7	+ 6	+ 4.0
Melbourne‡	126	11	+ 5	+ 4.0
Milwaukee	143	6	+ 4	+ 2.7
Los Angeles	211	7	+ 5	+ 2.4
Philadelphia	201	6	+ 4½	+ 2.2
Cleveland	205	8	+ 4½	+ 2.2
Newark	239	8	+ 5	+ 2.1
Bridgeport	152	6	+ 2½	+ 1.6
Waterbury	126	3	+ 1	+ 0.8
Pittsburgh	132	1	+ 1	+ 0.8
Hartford	137	3	.....	.....
Detroit	492	9	− 2½	− 0.5
Grand Rapids†	164	..	− 1	− 0.6
Second Group				
Buffalo	85	10	+ 9	+10.6
Rockford	67	6	+ 6	+ 9.0
Syracuse	85	8	+ 6	+ 7.1
Rochester	88	2	+ 2	+ 2.3
Baltimore-Washington	87	5	+ 1½	+ 1.7
Indianapolis	92	..	+ 1½	+ 1.6
St. Joseph Valley	71	1	+ ½	+ 0.7
St. Louis	105	..	.....	.....
New Haven	108	..	.....	.....
Toronto	121	..	− 1	− 0.8
Providence-Attleboro	100	..	− 1	− 1.0
Dayton	82	..	− 2	− 2.4
Cincinnati	88	1	− 3½	− 4.0
Montreal	77	1	− 4	− 5.2
Sydney	93	2	− 8	− 8.6
Third Group				
Dallas-Fort Worth	31	11	+11	+35.5
Houston	25	6	+ 7	+28.0
Louisville	23	1	+ 1	+ 4.4
Saginaw Valley	57	3	+ 1½	+ 2.6
Lancaster	60	2	+ 1	+ 1.7
San Francisco	65	4	.....	.....
Hamilton	25	..	.....	.....
Jackson-Lansing	52	..	.....	.....
Columbus	54	..	.....	.....
Springfield	54	2	− 1	− 1.9
Twin City	66	1	− 3½	− 5.3
Allentown-Reading§	42	..	− 3	− 7.1
Toledo	45	..	− 4	− 8.9
Adelaide	65	6	− 6	− 9.2
Southeastern	48	2	− 6	−12.5
Western Ontario	23	4	− 6	−26.1
Outside Competition				
At Large	120	8	+ 8	.....
In Transfer	16	..	+11	.....
Total A. E. S.	5,387	203	+93	+ 1.7

Active Membership, September 1, 1951 5,480

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1950–1951 membership competition.

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Secretary.....The Executive Secretary

Chairman.....Dr. DONALD PRICE
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40 Thames St., New York 6, N. Y.

LOCAL BRANCHES (With Changes Only)

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Edward Bruck, 824 Graham Avenue, Indianapolis 1, Ind.

ROCHESTER meets third Monday of each month at Rochester Institute of Technology. Secretary, Charles B. Fideor, 180 St. Casimir Street, Rochester, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 7:00 P.M. and business and technical session at 8:00 P.M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Co., 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, E. H. Lindemann, c/o Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

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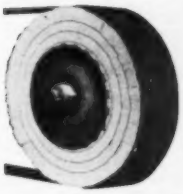

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Agency: The Advertising Corporation
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3RD ANNUAL METAL SHOW at Michigan State Fair Grounds, Detroit, Mich., on October 15–19.

INTERNATIONAL ASSOCIATION OF ELECTROTYPERS AND STEREOTYPERS 54th Annual Convention in Hotel Kenmore, Boston, Mass., on October 23–25.

15TH ANNUAL TIME AND MOTION STUDY CLINIC, sponsored by the Industrial Management Society, in Sheraton Hotel, Chicago, on November 1–2.

24TH INTERNATIONAL CONGRESS FOR INDUSTRIAL CHEMISTRY AND 1ST CHEMICAL EXHIBITION in Paris, France, on November 25–December 1.

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